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# **Chronology of KSC and KSC Related Events for 1977**

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CHRONOLOGY OF  
KSC AND KSC RELATED  
EVENTS FOR  
1977

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January 1977

**January 4:** A total of 1,137,367 visitors took the guided bus tours of the John F. Kennedy Space Center during 1976. This figure was 2.6 percent lower than the 1975 attendance. The 1976 total was the fifth busiest year since the tours were inaugurated in 1966. Since that time 10,372,729 people have taken the guided tours. The peak year was 1972 when 1,389,042 patrons toured the center. (NASA News Release No. KSC 3-77, January 4, 1977.)

**January 6:** NASA's John F. Kennedy Space Center has awarded a \$874,000 contract to the Frank Briscoe Co., Inc., East Orange, N.J., for construction and modification in Vehicle Assembly Building High Bay 3, in preparation for Space Shuttle assembly and checkout operations.

The contract provides for installation of piping systems to provide compressed air, freon 21, gaseous nitrogen and gaseous helium to the assembled Space Shuttle Orbiter-Solid Rocket Booster configuration; cable trays for electrical, operational communications system and instrumentation lines; and electrical and operational communications system cables. Electrical cables will be provided by the contractor and operational communications system cable by the Government. Instrumentation cables will be installed later under a separate contract.

Also included in the contract is the addition of work stands on the extensible platforms originally used during Apollo/Saturn V assembly and checkout operations at levels required for access to the Orbiter and Solid Rocket Boosters. The access platforms were reshaped and relocated to fit the Space Shuttle configuration under another contract.

The Briscoe Co. is also the contractor for construction of some of the Space Shuttle External Tank Processing Support Systems in the VAB High Bay 4 and a Solid Rocket Booster Processing and Storage Facility in High Bays 2 and 4. (NASA News Release No. KSC 5-77, January 6, 1977. Also NASA Contract No. NAS 10-9075, Dec. 12, 1976.)

- o NASA's John F. Kennedy Space Center awarded a contract for \$945,016 to the Chrysler Corporation's Michoud Defense-Space Division, New Orleans, La.

The contract - to be completed by June 30, 1977 - is for the manufacture and test of 100 hydraulic control panels to be used at the Kennedy Space Center in connection with the Space Shuttle Program.

The control units are ground support equipment which will be used to control the flow of hydraulic fluids to the Space Shuttle orbiter and solid rocket boosters, for test and servicing of onboard hydraulic systems prior to launch. (NASA News Release No. KSC 6-77, January 6, 1977. Also NASA Contract, Contract No. NAS 10-9086, December 22, 1976)

**January 7:** NASA awarded a contract for \$1,434,209 to the Mayfair Construction Co. and Capital Communication Corporation, a joint venture, of Chicago, Illinois. The contract calls for the installation of a utility control system and instrumentation and control cabling in the Hypergolic Maintenance Facility in KSC's Industrial Area. The contract also calls for the installation of electrical equipment racks and consoles, movable test platforms, and new power and lighting systems. (NASA News Release No. KSC 9-77, January 11, 1977. Also NASA Contract No. NAS 10-09082, January 7, 1977).

- o The Kennedy Space Center Exchange Council today released a request for proposals for concessionaire operation of a commercial service station on the Center.

Located in the KSC Industrial Area, the station has two islands with a capability of simultaneous fueling of four or more vehicles, and three service bays for vehicle lubrication, oil change and repair service.

The request for proposal provides for submission of sealed offers by February 5, 1977. The concessionaire contract will cover the period from July 1, 1977 through July 1, 1982.

B. W. Simpkins Oil Co., Cocoa, has operated the service station since 1972. (NASA News Release No. KSC 4-77, January 7, 1977)

**January 10:** NASA awarded a \$1,303,800 contract to the Holloway Corporation, Titusville, Fla., for the construction of a Solid Rocket Booster Refurbishment Facility in the Vehicle Assembly Building. The contract calls for modification of existing facilities in the VAB low bay area to serve as shops and work area related to refurbishing expended Space Shuttle solid rocket boosters for reuse. In addition, work platforms in four low bay cells will be removed or modified to permit subassembly and checkout of new or refurbished solid rocket boosters. The contract also calls for modifications to a portion of the ground plan of Tower C in the High Bay area for an Ordnance Build-up Facility. (NASA News Release No. KSC 8-77, January 11, 1977. Also NASA Contract No. NAS 10-09088, January 10, 1977)

**January 11:** John Yardley, Associate Administrator for Space Flight, told a press conference that it would be significantly more cost-effective for the nation to fund five Space Shuttle Orbiter vehicles at this time rather than to stick with the two RDT&E vehicles that have been funded to date and which will fly beginning in 1979.

Asked if NASA had funds for the third Orbiter, Yardley commented that the agency would not need such funds prior to the FY '78 budget. However, it seems likely that the funding of the third Orbiter will be included in the upcoming budget. NASA last year was forced by OMB to "defer" go-ahead on the third Orbiter, which cut about \$100 million from its budget request, and a further delay would make the planned mission schedule for the Space Shuttle more risky, since Orbiter 103 is the immediate back-up for the first two Orbiters.

This still leaves the question of the fourth and fifth Orbiters, which would be used by the Defense Department but which DOD does not want to fund, saying the money should be included in the NASA budget. NASA wants the funding for the fourth and fifth Orbiters to be in the DOD budget.

The decision on whether or not to fund the two additional Orbiters and from whose budget is to be answered in President Ford's FY '78 budget.

Yardley pointed out that even if the 267 NASA missions contained in the 560-flight Space Shuttle mission model for the 1980-1992 time period were cut in half, the saving by using five Orbiters rather than two would be \$5.5 billion. (Defense/Space Daily, Vol. 90, No. 9, Thursday, January 13, 1977.)

- o NASA's proposed reimbursement policy (user charges) for use of the Space Shuttle to place payloads in orbit will be published in the Federal Register very shortly.

The user charges, which have been in rough form since last fall, are expected to undergo further refinements even after they are published.

Yardley also discussed Shuttle user charges. Aspects of the reimbursement policy as they now stand were spelled out as follows:

\*A fixed price of \$19 million to \$21 million (FY '75 dollars) will be charged for dedicated missions (taking up the full Shuttle payload bay) for commercial and foreign users of the Shuttle. Contracts are to be signed 33 months prior to launch and will usually run through three years of operation. Determination of the inflation rate on the FY '75 dollars will be made through some Government index.

\*A shared payload price equal to 133 percent of the dedicated payload price for the space taken will be provided. NASA will have to fill up three-fourths of the payload bay to break even on this charge. The cost, for example, for an average Delta-class mission will be about \$6 million not including an upper stage. (Four Delta-class payloads can be accommodated in the payload bay.) The cost for a small Delta-class mission would be less one has been proposed to NASA which the agency says could be flown for \$3.4 million. Under this policy, NASA would guarantee flight within a two-month period.

\*A 20 percent discount will be provided to users who agree to stand-by launch of their payload for a period up to one year.

\* Short-term call-ups will be made available to users.

\* Payloads which are deemed by NASA to have "exceptional" utility to the public can obtain a special rate--about one-half of the regular price.

\* A special price will be given to small, self-contained R&D payloads which can operate without power or services from the Shuttle, and which will be flown on a space-available basis. A payload weighing 200 pounds and occupying five cubic feet would cost about \$10,000 (FY '75 dollars). Payloads smaller than this could be launched for as low as \$3000. (This will be the minimum price.)

Yardley reiterated that the reimbursement policy is not designed to recoup development costs of the shuttle. He said this has always been NASA's policy.

The NASA associate administrator said that the user community appears to be "delighted" with the planned prices. He noted that the cost of a Delta launch is \$18-19 million, versus the \$6 million possible on the Shuttle. (Defense/Space Daily, Vol. 9, Thursday, January 13, 1977.)

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- o NASA's John F. Kennedy Space Center has awarded a fixed price contract for \$1,395,163 to the Mayfair Construction Co. and Capital Communication Corp., a joint venture, of Chicago, Ill.

The work includes installation of a utility control system and instrumentation and control cabling in the Hypergolic Maintenance Facility in KSC's Industrial Area.

It also includes installation of electrical equipment racks and consoles, movable test platforms, new power and lighting systems and associated work designed to adapt structures originally erected for Project Apollo to new roles in the Space Shuttle era.

The Space Shuttle Orbiter's fore and aft secondary engines use hypergolic or self-igniting propellants. These elements will be checked out and serviced in the Hypergolic Maintenance Facility.

Work under the contract - one set aside for small business concerns - is to be completed by August, 1977. (Defense/Space Daily, Vol. 90, No. 9., Thursday, January 13, 1977. Also NASA News Release No. KSC 9-77, January 11, 1977)

**January 12:** Appointment of Richard H. Mundy as the Kennedy Space Center's Deputy Chief Counsel has been announced by Chief Counsel Edward F. Parry.

The office of the Chief Counsel is responsible for all legal advice to the Center Director and other elements of KSC as well as other NASA offices located at the Center.

Mundy, who transferred to the Spaceport from the Marshall Space Flight Center in 1968, previously served as Chief of the KSC Procurement Counsel Staff.

Born in Philadelphia, Pa., he was graduated from high school in Conshohocken, Pa., in 1943. After serving in the Air Force as a navigator from 1943 to 1948, he studied at Drexel University, receiving his BS degree in Business Administration in 1951.

Returning to Air Force active duty in 1951, he remained in the Air Force until his retirement with the rank of Lieutenant Colonel in 1966. While on Air Force active duty he attended the University of Houston Law School and received his Doctor of Jurisprudence degree in 1957.

Mundy, who served as a member of the Marshall Center's legal staff from 1966 to 1968, is a member of the Brevard and Florida Bar Associations and has been admitted to practice before the U. S. Supreme Court. (NASA News Release No. KSC 7-77, January 12, 1977)

**January 14:** The modified Boeing 747 which will be used for a series of unpowered approach and landing tests of the Space Shuttle Orbiter was delivered to Rockwell International in South Seattle, Washington. The plane will be flown to NASA's Dryden Flight Research Center for final preparations prior to the approach and landing test programs scheduled to begin in February 1977. (Defense/Space Business Daily, Vol. 90, No. 11, Monday, January 17, 1977.)

January 17: NASA's FY-78 budget was approved and submitted to the Congress by President Ford. The \$4.0198 billion dollar request represents a 7.9 percent increase over the FY-77 appropriation but is \$169.3 million less than NASA's request to the Office of Management and Budget. Included in the budget was \$141.7 million to initiate production of the third fourth and fifth Space Shuttle Orbiters. NASA Administrator Dr. James Fletcher said the '78 budget is "in line with last year's projections, and in overall terms just about keeps abreast of anticipated inflation."

NASA Comptroller William E. Lilly estimated that the FY-78 Budget submitted by President Ford includes approximately \$140 million for new programs in addition to Orbiters 3, 4 and 5. Funding was provided for new starts on a Space Telescope, a Jupiter Orbiter/Probe, Landsat spacecraft, Mars follow-on studies, Explorers and the development of the sun powered Solar Sailors.

Reductions to NASA's budget request included 133 million dollars in Research and Development programs, 29.7 million in facility construction and \$5.7 million in Research and Program Management funds. NASA will also be expected to reduce its personnel from 24,039 employees to 23,816 employees by September 1978. (Defence/Space Business Daily, Vol. 90, No. 12, January 18, 1977. Also, 1978 NASA Authorization, Hearings, Committee on Science and Technology, U.S. House of Representatives, Ninety-fifth Congress, First Session, Volume III, No. 8, February 1, 1977, pp 26-41.)

- o NASA's John F. Kennedy Space Center awarded a \$2,876,935.58 contract to the Michoud Defense Space Division of the Chrysler Corporation, 13800 Gentilly Road, New Orleans, La.

The contract, to be completed by December 1, 1977, provides for Chrysler, at its Michoud Assembly Facility, to fabricate and furnish 70 high pressure pneumatic regulation and control panels to be utilized at Complex 39 for pressurizing the Space Shuttle vehicle and associated ground support equipment during checkout and launch operations.

Panels will be installed at Pad A, the Orbiter Processing Facility and the Hypergol Maintenance Facility.

Kennedy Space Center facilities used for Apollo/Saturn checkout and launch operations are now undergoing modifications in preparation for checkout and launch of Space Shuttle vehicles, beginning in 1978. (NASA News Release No. KSC 39-77, February 4, 1977. Also Contract No. NAS10-9092, dated January 17, 1977)

January 21: Pat Lowry has been selected as the new Federal Women's Program Coordinator (FWPC) at the Kennedy Space Center.



Lowry has been an administrative specialist with the Technical Support Directorate, an organization that she has worked for since 1966. She began her government career at that time as a clerk typist, became a clerk stenographer, an administrative services clerk, then an administrative specialist. In her new position she will be assigned to the Equal Employment Opportunity office.

Lowry is a member of Space Coast Chapter of Federally Employed Women, and has held several offices including president; an officer in the Brevard Community College Faculty Women's Club (her husband is a faculty member); and a member of the Brevard County Equal Rights Amendment Coalition for the past five years. In addition to her regular duties, Lowry served for 2-1/2 years as an Equal Employment Opportunity counselor at KSC. She was selected by the Space Coast Chapter of FEW as 1976 Member of the Year.

Lowry was born in Kentucky, where she attended high school, business school and the University of Kentucky. (NASA News, Release No. KSC 12-77, January 21, 1977)

**January 24:** NASA has received its first orders to provide space on the Shuttle for small, self-contained payloads that will fly on a space available basis beginning in 1980.

NASA pricing schedules for Shuttle payloads provide for payloads termed as "getaway specials". These are small, self-contained payloads that will fly on a space available basis. The getaway specials will be orbited at a cost of \$3000 to \$10,000 each (1975 dollars). To qualify for these special rates, the payload must not exceed 200 pounds in weight, must measure less than five cubic feet, be for research and development purposes, and require no Shuttle servicing such as electrical power or deployment.

The initial four customers, who have deposited \$500 in earnest money with NASA for each payload (to be applied to the final cost of the service), are:

- \*R. Gilbert Moore, a private citizen from Utah, who plans to orbit research equipment, and who has offered half of his payload to Utah State University.

- \*Dr. L. R. Megill, chairman of the Space Sciences Experiment Committee at Utah State, who will fund a \$3000 payload as a follow-on to Moore's.

- \*Reiner Klett, a German consultant representing independent German researchers, has signed for two \$10,000 payloads, one for a space processing experiment, and one for a biological experiment.

- \*Battelle Memorial Institute, which has purchased two \$10,000 payloads for materials science research.

NASA plans to start operational flights of the Space Shuttle in 1980, with five operational missions scheduled that year. A Space Flight Projection

released last week shows 15 shuttle flights in 1981, 24 in 1982 and 39 in 1983, figures slightly different from those in the 560 flight 1980-1992 traffic model. (Defense/Space Business Daily, Vol. 90, No. 15, Monday, January 24, 1977.)

**January 27:** NATO-IIIB was successfully launched aboard Delta 128 at 7:49 p.m., EST from Launch Complex 17A. The spacecraft was placed in a transfer orbit with an apogee of 35,922 kms. and a perigee of 184 kms. The expected apogee and perigee were 35,977 kms and 184 kms respectively. The NATO-IIIB is the second in a series of three military communications satellites to be used by the North Atlantic Treaty Organization in the NATO Integrated Communications System. The spacecraft will subsequently be placed in a new geosynchronous orbit above the equator over the Atlantic ocean at approximately 15 degrees west longitude. (Launch Mission Summary and Sequence of Events, NATO-IIIB, Delta 128, KSC, NASA, January 6, 1977. Also, Mission Operations Report No. M-492-207-77-02, January 18, 1977, and February 14, 1977.)

- o After temperatures dipped to the low 20's in Florida for three consecutive nights (January 19, 20, 21), Robert Yoder, Manager of the Merritt Island Wildlife Refuge--assisted by members of his organization, fishermen, private citizens, members of the Florida Marine Patrol, and students from Florida Technological University--collected 140 cold-stunned sea turtles from Mosquito Lagoon and the Banana and Indian Rivers. The sea turtles, greens, Loggerheads, and Atlantic Redley, are sensitive to water below 50 degrees. Water in the Mosquito Lagoon had dropped to 39° F, sufficiently cold to anesthetize the large reptiles. The largest, a Loggerhead, weighed 243 pounds. Over a hundred of the larger turtles were placed in the swimming pool in the KARS recreation area where water temperature was 64° F. Smaller turtles were kept in plastic wading pools at the FTU laboratory on the northern end of KSC. The turtles were tagged and released after a recovery period. (NASA News Release No. KSC 25-77, January 27, 1977.)

**January 31:** The first Space Shuttle Orbiter, OV-101, departed the Rockwell International plant in Palmdale, California, on board its 90-wheeled transporter for the 12 hour, 38-mile ride to NASA's Dryden Flight Research Center. Orbiter 101 is configured to evaluate vehicle approach and landing performance during the terminal phase of future operational missions. The current approach and landing test program calls for 6 must-capture tests with the tail cone on; 5 active capture tests; 5 free flights with the tail cone on; and 1 capture flight and 3 free flights with the tail cone off. The test objectives are: to verify an Orbiter pilot-guided approach and landing capability; to demonstrate an Orbiter autoland capability; to verify Orbiter subsonic air worthiness, integrated systems operations, and selected subsystems operation for first orbital flight; and, to demonstrate an Orbiter capability to safely approach and land in a selected control weight and center of gravity configuration. Following the approach and landing test programs, Orbiter 101 will be ferried aboard the Shuttle Carrier Aircraft to the Marshall Space

Flight Center for a series of structural test analyses. Later, the Orbiter 101 will be returned to Rockwell's Palmdale plant to undergo modifications to convert it into a space flight configuration. (Space Shuttle Program Orbiter Approach and Landing Test Pre-ALT Report, Office of Space Flight, NASA, Executive Management Services Directorate (AEM), dated February 11, 1977. pp 1-3. Also, Spaceport News, Vol. 16, No. 4, John F. Kennedy Space Center, February 18, 1977.)

FEBRUARY 1977

**February 1:** NASA's John F. Kennedy Space Center has awarded a \$50,000 contract extension to the University of Arizona, Tuscon, Arizona, for continued study of changes in thunderstorm electrical fields and other thunderstorm phenomena in the Spaceport area.

The contract modification extends a contract originally awarded in April, 1974, to January 15, 1978, and brings the total contract value to \$116,000.

Dr. Phillip Krider of the University of Arizona, internationally recognized meteorologist, is among the scientists working with University of Arizona graduate and undergraduate students on the project. Under the contract, the university's Institute of Atmospheric Physics conducts studies during summer thunderstorm activity, utilizing KSC's sophisticated instrumentation system.

The contract provides for a detailed study of electric field changes and recovery curves created by lightning under varied meteorological conditions. Dr. Krider will supervise development of computer programs to determine and display the location of lightning discharges and thunderstorm characteristics.

The study is expected to develop methods and techniques to enhance and evaluate KSC's present meteorological system so that all aspects of Space Shuttle vehicle processing, launch and landing operations may be conducted safely and efficiently even under marginal environmental conditions.

The university's effort will be coordinated with programs of the many government, university and private industry agencies that will be involved in thunderstorm research at KSC next summer.

The University of Arizona efforts supplement a program co-sponsored by the American Geophysics Union and American Meteorological Society known as TRIP (Thunderstorm Research International Program).

The program provides for 20-25 prominent atmospheric scientists to conduct research at KSC. KSC hosted the research teams and supported their activities during the summer of 1976. The teams will return to the Center in the summers of 1977 and 1978 to continue research. (NASA News Release No. KSC 33-77, February 1, 1977)

**February 2:** After arriving at the Dryden Flight Research Center, the Orbiter 101 was positioned in the Mate/Demate Device for off-loading from the transporter. However, excessive winds delayed the off-loading process until February 2. An inspection of the Orbiter identified several items to be worked prior to the first capture test on board the Shuttle Carrier Aircraft. Work items included repairing rings and replacing rivets on the External Tank doors; replacing two damaged mid-fuselage struts; installing the Orbiter Maneuvering System POD/Orbiter fairings; increasing area of tail cone vents; and, installing body flap fairings. The left hand external tank door was removed and returned to Palmdale for repair. The tail cone access doors were also removed and returned to Downey. (Approach and Landing Daily Status Report, February 2, 1977.)

**February 3:** The Kennedy Space Center's Crawler Transporters were designated National Historic Mechanical Engineering Landmarks at a ceremony held here by the American Society of Mechanical Engineers (ASME) at 2 p.m., Thursday, February 3.

The largest land vehicles ever built, the crawler transporters were used throughout the Apollo and Skylab eras to move massive space vehicles and ground support facilities around Launch Complex 39. They will also be used in Space Shuttle operations at KSC.

Participating in the ceremony were Jim Roy, Atlanta, Ga., Southeastern Regional Vice President, ASME; Dr. Paul Hatman, head of the Civil Engineering Department, Florida Technological University, Orlando, associated with ASME; D. D. Buchanan, Associate Director for Design, KSC, who directed crawler construction; Dr. Stothe P. Kezios, Director, School of Engineering, Georgia Institute of Technology, ASME National President-Elect; and Raymond L. Clark, Director of KSC's Design Engineering Directorate. (NASA News Release No. 26-77, January 27, 1977. Also, Spaceport News Vol. 16, No. 4, John F. Kennedy Space Center, February 18, 1977.)

- o KSC awarded a \$309,500 contract to Booz Allen Applied Research of Bethesda, Maryland, to perform a study of operational management systems for Space Shuttle operations once the Shuttle is declared operational. In performing the study, the contractor was to consider four management options, evaluating and comparing each option, and to recommend the optimum operational method based upon the study results.

The first option, Option 0, called for the continuation of the management of operations used during the design, development, test and evaluation phase. Management of the STS would be carried out very similarly to the management operations of the Apollo, Skylab and ASTP programs. Civil Service has a major role in overall management, operations and engineering responsibilities.

The second option, Option 1, calls for combining the operations of the various flight hardware development contractors under a single mission type STS operations contractor. In addition, the several payload carrier development contractors, such as Spacelab, Interim Upper Stage, and Solid Spinning Upper Stage Contracts, will be combined under the management of a single payload carrier operations contractor. Under option 1, the two operations contractors and various support contractors would report contractually to NASA.

In the third option, Option 2, KSC Civil Service assumes prime responsibility for flight vehicle operations and engineering at the launch site. In the prime responsibility role KSC Civil Service is supported by two mission type support contractors and various institutional support contractors. One mission type contractor will provide technicians and operating engineers to perform flight hardware processing. The other mission type contractor will provide technical support for the flight hardware processing team.

The fourth option, Option 3, calls for the several Shuttle flight elements and payload carrier development contractors to be replaced by a single mission-type STS operations contractor during the transition from the DDT&E phase to the operational phase. The analyses and evaluations were to be completed seven months after the February 14, 1977, effective date of the contract. (NASA Contract, Contract No. NAS10-9098, February 3, 1977.)

**February 4:** The United States Senate's Standing Committee on Aeronautical and Space Science, established on July 24, 1958, was officially abolished. The committee was abolished as a part of a Senate-approved reorganization plan to reduce the numbers of standing committees from 31 to 24. The functions of the Aeronautical and Space Science Committee will be merged into the functions of an expanded Committee of Commerce, Science and Transportation. Senator Warren Magnuson, Chairman of the old Commerce Committee, will chair the new committee. According to Magnuson, once the new committee was organized he would establish a subcommittee on aeronautics and space. (Defense/Space Business Daily, Vol. 90, No. 26, Thursday, February 8, 1977.)

**February 7:** NASA's John F. Kennedy Space Center has awarded a fixed price contract for \$153,124 to Russell & Axon, Daytona Beach, Fla.

The contract is for architect-engineer services for the design of miscellaneous systems, rehabilitations, repairs and modifications of various NASA facilities located on KSC and Cape Canaveral Air Force Station.

Among the specific tasks are rehabilitation of the water system for the Operations and Checkout Building, and the high temperature water system in the

Industrial Area, and the modification of the ventilation system in the high bay of the Vehicle Assembly Building.

Work under the contract is to be completed by July 6, 1977. (NASA News Release No. KSC 40-77, February 7, 1977. Also Contract No. NAS10-9103, February 1, 1977).

**February 10:** Solar energy units will be in operation at three KSC facilities for water heating purposes by October, helping relieve the Center's reliance on energy from fossil fuels.

Wallace H. Boggs, Energy Projects Coordinator on the staff of Raymond L. Clark, Director of Design Engineering, identified the three facilities as the Visitors Center cafeteria, the Banana River Repeater Station and the KSC Headquarters Building.

The first two projects should be in operation in late May and the latter should be completed by October.

The Visitors Center installation will be able to supply up to 70 percent of water heating needs for the cafeteria. Water will be heated in a 176-square-foot flat plate collector to be located on the ground adjacent to the cafeteria. A conventional water heating system will provide the balance of hot water needs and serve as a backup during long periods of cloudy weather.

The Banana River Repeater Station is an electronic communications relay building located near the eastern shore of Merritt Island. The 470-square-foot flat plate collector array will provide up to 70 percent of the hot water needed for heating and air conditioning reheating.

Design work on these two projects is 90 percent complete.

The Headquarters Building project is now going into the design phase and will require a 4,000-square-foot flat plate collector array on the ground nearby.

This system is to provide 70 percent of the hot water needs of the structure's four central wings, including the cafeteria.

All three systems will have the capability of heating water to 205 degrees Fahrenheit but the rate of water flow through the collectors will be

adjusted so that it moves into insulated hot water storage tanks at a maximum temperature of 140 degrees F.

The flat plate collectors will be constructed facing south and angled at 28 degrees for maximum heating efficiency.

The Headquarters Building project is being funded jointly by the Energy Research and Development Administration (ERDA) and NASA. Energy savings should amount to \$11,000 for the first year of operation and \$151,000 over an eight-year period.

The Visitors Center and Repeater Station projects are being funded entirely by NASA. The energy savings should amount to approximately \$2,500 for the first year of operation and \$34,000 over an eight-year period. (NASA News Release No. KSC 56-77, February 10, 1977)

**February 16:** Necessary modifications for mating the Orbiter 101 and the Shuttle Carrier Aircraft were completed and the two vehicles were mated on February 6. On February 10, the mated vehicles were moved to the Ground Vibration testing hangar for 5 days of vibration testing. A taxi test of the vehicles was successfully made on February 15, paving the way for the first captive inert flight test on February 18. (Approach and Landing Test Daily Status Reports, dated February 9, 11, 15 and 16, 1977)

**February 17:** A one-year extension of a contract for custodial services at NASA's John F. Kennedy Space Center has been awarded to Expedient Services, Titusville, Fla.

The \$1,870,000 award covers the period from February 1, 1977, through January 31, 1978, and brings the cumulative value of the contract to \$7,327,197 since the contract was originally awarded February 1, 1973.

The fixed price contract is a small business award, a set-aside for disadvantaged firms. The contract was awarded by the Small Business Administration, Atlanta, Ga., on behalf of KSC.

NASA actively pursues efforts to increase participation of small business firms in its procurement program. (NASA News Release No: KSC 67-77, February 17, 1977. Also, Contract No. NAS10-9099, February 1, 1977)



February 18: Dan Fergus (D-Fla.), Larry Winn (R-Kan) and Lou Frey (R-Fla), members of the House Subcommittee on Space Science and applications, visited KSC on February 4. They were accompanied by Congressional Staff members and two representatives of NASA's Office of Legislative Affairs. During the one day visit the group toured KSC facilities, visited demonstrations and exhibits and was briefed on Shuttle preparations currently underway. (Spaceport News, Vol. 16, No. 4, February 18, 1977.)

- o The first flight of the mated SCA/Orbiter was performed on February 18, 1977. The following includes the pertinent statistics related to the flight:

Crew: Pilot: Fitz Fulton  
Co-Pilot: Tom McMurtry  
Flt Engrs: Vic Horton, Skip Guidry  
Total Flt Time: 2 hours 10 minutes  
Max Speed: 251 KCAS  
Max Altitude: 14,200 feet  
Tak-off Gross Wt: 583,500 pounds  
Landing Gross Wt: 504,500 pounds  
Average Center of Gravity: 26% MAC

The primary objectives of the flight were to:

- 1) Evaluate the airworthiness of the configuration within the flight envelope.
- 2) Obtain stability, control, loads, performance, and airspeed system calibration data.
- 3) Check procedures and system set-up for the subsequent flutter envelope expansion flights.

Of the above objectives all were accomplished as planned with one exception. At the test altitude of 10,000 feet and an airspeed of 145 KCAS, the thrust moment balance test to evaluate the directional stability was omitted, as it appeared the fuel remaining was approaching the minimum targeted for landing. (Approach and Landing Test Daily Status Report, February 21, 1977.)

- o KSC's energy conservation efforts, started in 1973, resulted in a 33 percent reduction in energy consumption during FY-76. During fiscal year 1973, KSC consumed 261,200,000 kilowatt hours of electricity at a cost of 2.9 million dollars. By FY-76, consumption had dropped to 162,646,000 kilowatt hours. Rate increases which more than doubled brought the cost to .8 million more, or 3.7 million dollars. Without the reduction, however, the cost would have been 5.9 million dollars. Fuel oil used for heating, KSC's second biggest energy expenditure, has also been reduced. The center used 794,000 gallons during the first quarter of FY-76, compared to 718,000 gallons during same period in FY-77. (Spaceport News Vol. 16, No. 4, February 18, 1977.)

**February 22:** The second flight of the mated SCA/Orbiter was conducted on February 22, 1977. Pertinent statistics relative to the flight are as follows:

Pilot: Fitz Fulton  
Co-Pilot: Tom McMurtry  
Flight Engrs: Vic Horton, Skip Guidry  
Total Flt Time: 3 hrs. 15 minutes  
Maximum Speed: 287 KCAS

Maximum Mach No.: 0.61  
Max Dynamic Pressure: 275 psi  
Max Altitude: 22,465 feet  
Take-off Gross Weight: 626,000 pounds  
Landing Gross Weight: 507,000 pounds  
Average C.G.: 23% MAC (Total Configuration)

The primary objectives of this flight were:

- 1) To demonstrate that the mated configuration is flutter free within the flight envelop.
- 2) To evaluate stability and control at discrete speeds within the envelope.
- 3) To evaluate the stick shaker reference speeds at a heavy gross weight for a range of gear down and flap conditions.
- 4) To complete the airspeed system calibration with a pacer aircraft.

All of the above test objectives were accomplished as planned. The test condition omitted on the previous flight at  $V_i=145$  KCAS and 10,000 feet in the landing configuration, to evaluate directional stability, was performed prior to landing. (Approach and Landing Test Daily Status Report, February 23, 1977)

**February 23:** President Carter added 15 million dollars to the FY'78 NASA budget submitted to Congress by out-going President Ford. Ten million dollars is earmarked for technical definitions and evaluation of alternative future missions to Mars, and five million is to support a back-up spacecraft for Landsat-D. It is to be used to start design and procurement of mission-unique equipment and the ground data processing system for this back up spacecraft, and to start procurement of the Multi-mission Modular spacecraft subsystems for the Landsat. (Defense/Space Business Daily, Vol. 90, No. 36, Wednesday, February 23, 1977.)

February 23-24: Center Director Lee R. Scherer initiated a new avenue of communication with the Center's management. Scherer presented a "State of the Center Address" to 350 KSC supervisory personnel, half on Wednesday and half on Thursday. In his presentation he pointed out that the general state of the Center was very healthy -- the work force was stable except for a few minor adjustments yet to be made. He announced the establishment of a new office to consider all award programs -- that Center Directors were authorized to award employees up to 2500 dollars and he intended to exercise that authority whenever it was warranted. Scherer pointed out that the President Carter budget submission for NASA was very encouraging. The increases (over NASA's submission) proposed by Carter was for a new Landsat spacecraft and for new starts for a Space Telescope and a Jupiter landing probe. (Spaceport News, Vol. 16, No. 5., March 4, 1977.)

February 25: Sen. Adlai E. Stevenson said that he believes that the Space Agency's overall budget "should remain fairly level."

Stating that it is "important for the nation that NASA's activities proceed in an orderly and efficient manner," Stevenson laid out the following general principles which he believes the subcommittee should follow regarding NASA's budget:

- 1) There should be a continuing emphasis on programs that directly benefit the public.
- 2) The overall NASA budget should remain fairly level, barring unforeseen exigencies, to avoid precipitous manpower buildups or layoffs which are costly and make effective planning by the agency difficult.
- 3) A proper balance should be maintained in NASA's budget between basic research and technology applications. Similarly, an appropriate balance between aeronautics and space should be preserved in what is now a space-oriented agency.
- 4) In undertaking space science projects, the objective should be science, not space spectaculars.
- 5) New initiatives should be thoroughly evaluated and weighed against the needs of the nation. Once a new project start is approved by the Congress, support should continue through to completion as long as the program is well managed and its basic rationale is justified.
- 6) NASA and the Science and Space Subcommittee should be prepared to cast off any shackles from the past -- inertia and habit -- and examine new ideas with an open mind, including such possibilities as greater contribution by agencies of industry and government for the benefits provided to then by NASA.

The new Subcommittee on Science and Space of the Senate Commerce Committee, chaired by Senator Adlai E. Stevenson opened hearings on NASA's FY-78 budget request. Other members of the committee in attendance were Senators Wendell H. Ford, Barry Goldwater, Bob Packwood and Harrison H. Schmitt. (NASA Authorization for Fiscal Year 1978, Hearings, Subcommittee on Science, Technology, and Space, U.S. Senate, Ninety-fifth Congress, First Session, February 25, pp 729-730. Also Defense/Space Business Daily, Vol. 90., No. 39, February 28, 1977.)

**February 28:** The fourth mated inert captive flight of the SCA/Orbiter was performed on February 28, 1977. The following lists the pertinent information relative to this flight:

Pilot: Fitz Fulton  
Co-Pilot: Tom McMurtry  
Flight Engineers: Vic Horton, Skip Guidry  
Total Flight Time: 2 Hours 11 Minutes  
Maximum Speed: 290 KCAS  
Maximum Mach No: 0.67  
Maximum Dynamic Pressure: 272 psi  
Maximum Altitude: 28,565 feet  
Takeoff Gross Weight: 589,000 pounds  
Landing Gross Weight: 511,000 pounds  
Average Center of Gravity: 25.5% MAC (Total Config.)

The primary objectives of this flight were:

- 1) To evaluate the buffet levels associated with SCA wing spoiler deployment under flight conditions similar to those specified for the ALT launch mission.
- 2) To conduct a stability and control evaluation related to the ALT launch configuration and operational profile.
- 3) To obtain a preliminary assessment of the Special Rated Thrust (SRT) performance relative to the projected ALT launch altitude.

Of the above test objectives, all were accomplished as planned. In addition to the basic test plan, time and fuel remaining provided an opportunity to obtain some performance data prior to landing. A set of speed power data was recorded at V-140 KCAS at an altitude of 5000 feet with landing gear up and flaps set at 20 degrees. During the phase II testing, this speed and flap setting produced questionable results; and the intent in repeating the test for the mated configuration was to check for similar trends. Also, in conjunction with the basic test objectives, there was an opportunity to evaluate pilot technique in extending and retracting the in-flight spoilers relative to the ALT launch. Finally, due to the continuing problem related to the main landing gear door closure, though component changeouts had been made in the landing gear system prior to flight, the problem of landing gear door opening in flight persisted. The problem can be controlled, so there is no flight safety problem. Another post-flight assessment of this malfunction

is being made. (Approach and Landing Test Daily Status Report, dated March 1, 1977.)

## MARCH 1977

**March 2:** The fifth mated inert captive flight of the SCA/Orbiter was performed on March 2, 1977. The following includes the pertinent statistics relative to this flight:

Pilot: Fitz Fulton  
Co-Pilot: A.J. Roy  
Flight Engrs: Vic Horton, Skip Guidry  
Total Flight Time: 1 hr. 40 min.  
Max Speed: 282 KCAS  
Max Mach No: 0.69  
Max Dynamic Pressure: 251 PSI  
Max Altitude: 30,130 feet  
Takeoff Gross Weight: 554,000 pounds  
Landing Gross Weight: 499,300 pounds  
Average Center of Gravity: 25.5%

The primary objectives of this flight were:

- 1) To simulate the ALT Launch Profiles for a two launch attempt mission.
- 2) To evaluate the separation aerodynamics, loads, and procedures.
- 3) To assess SCA performance related to the launch mission.

The above test objectives were all accomplished as planned. In addition, a speed power performance test was conducted at  $h_p = 15,000$  ft. and  $V_i = 191$  KCAS during the descent to the landing. Further, the SCA main landing gear doors still tended to open with the handle in the neutral position; so before landing a series of gear extensions and retractions were performed to assess this problem.

As in the previous flights, this flight was considered a complete success from the view of the SCAT Team. The data obtained will serve to verify the launch criteria, and completes the requirement to satisfy the verification that the SCA is ready for the next phase of Approach and Landing Testing, Captive Active Flights. (Approach and Landing Test Daily Status Report, dated March 3, 1977.)

**March 4:** Preparations were under way at KSC for the twin launches of Mariner (Voyagers 1 and 2) spacecraft on flights to Jupiter, Saturn and eventually Uranus. Launch of the first spacecraft from LC-41 is scheduled for August 20, the second ten days later. The seventeen hundred pound spacecraft will be equipped with the necessary instrumentation to study and photograph the planets, their satellites and the rings of Saturn. Both wide-angle and narrow-angle cameras are expected to provide scientists with clear, high

resolution photographs. In addition the Mariners will carry cosmic-ray detectors, infrared spectrometers and radiometers as well as other instrumentation to advance man's knowledge of the outer reaches of the solar system. (Spaceport News Vol. 15, No. 5, March 4, 1977.)

- o More than 150 community leaders from chambers of commerce throughout Brevard County were briefed on current and future activities at KSC at a Continental Breakfast.

The breakfast and a briefing by KSC Director Lee R. Scherer was held in the Mission Briefing Room of the Operations and Checkout Building in the KSC Industrial Area.

A tour of KSC was provided to those who desired it. (NASA News Release No. KSC 62-77, February 24, 1977.)

**March 10:** NASA and the Department of Defense have agreed on a plan to reimburse NASA for DOD Shuttle launches. The reimbursement will be based on costs of materials and services. For the first six years the cost will be based on average projected costs for these items. After six years the costs will be adjusted annually based on actual forecasted costs for each year. Launch support will be provided by DOD for all Shuttle launches at Vandenberg and by NASA for all launches from Kennedy Space Center. The Mission Control Center at Johnson Space Center will plan and control DOD flights of the Orbiters but once on orbit, control of the interim upper stage and the payload, after separation from the Orbiter will pass to the Air Force Satellite Control Facility. (Defense/Space Business Daily Vol. 91, No. 8, March 10, 1977.)

**March 10-12:** Palapa-B, an Indonesian domestic communications satellite, was successfully launched into a transfer orbit on board Delta Rocket No. 129 from Pad 17A on the Eastern Test Range. This was the second of two communications satellites launched by the Expendable Launch Vehicle launch team for the Indonesian government. Performance of the Delta vehicle was nominal and the spacecraft was placed in a transfer orbit. The measured orbital parameters were 36,499 km. apogee and 231.2 km perigee. The expected parameters were 36,522 kms apogee and 231.6 kms, perigee. At 6:10 p.m. EST on March 12 the satellite was maneuvered into a synchronous orbit over the Indian Ocean. Palapas A and B were built by Hughes Aircraft Company and are designed to provide television, voice, data, etc., throughout Indonesia. The satellite was named for an Indonesian delicacy which Gaja Mada, a 14 Century Prime Minister, vowed not to eat until Indonesia was united. (Prelaunch Mission Operations Report No. M-492-208-77-02, February 9, 1977. Also, Post Launch Mission Operations Report No. 111-492-208-77-02, April 12, 1977)

**March 11:** NASA's John F. Kennedy Space Center has awarded a \$869,727 contract extension to the Bionetics Corporation, 18 Research Drive, Hampton, Va., for continuation of reference standards services and calibration of instruments in support of NASA operations.

The cost plus fixed fee contract extension, for the period from May 1, 1977 through April 30, 1978, brings the total value since the contract was initiated in 1976 to \$1,479,731.

The Kennedy Space Center launches expendable boosters with unmanned scientific and applications spacecraft from complexes at Cape Canaveral, Fla., and Vandenberg AFB, Calif., and is modifying facilities at the Spaceport for manned Space Shuttle launch and landing operations. The first Space Shuttle launch is scheduled in 1979. (NASA News Release No. 74-77, March 11, 1977.)

**March 16:** According to NASA Administrator, Dr. James C. Fletcher, NASA plans to begin development of a Space Construction Base in 1980 to be operational by 1985. He also told of a recent NASA sponsored study of a 10,000 person space settlement which would take approximately 20 years to construct after the decision is made to do it. Other future plans include: a combination of a Mars Orbiter and Mobile Lander mission in 1984 and a Mars Sample Return Mission in 1988; a Venus Orbital Radar Mission in 1980; a pair of Saturn - Uranus probes to be launched in 1985 and 1986 which will make atmospheric surveys; a Solar Sail mission in 1982 to rendezvous with Halley's Comet; and to follow the Space Telescope mission with an infrared telescope mission in 1983 and an ultraviolet telescope mission in 1985. (Defense/Space Business Daily, Vol. 91, No. 14, March 18, 1977.)

**March 17:** The House yesterday approved the \$4,053,829,000 FY '78 authorization for NASA recommended by its Science and Technology Committee, representing an increase of \$19 million over the amount requested by President Carter and \$34 million over the amount requested by President Ford. The measure, approved 338 to 44, is \$329.5 million above NASA's FY '77 budget. The FY '78 authorization includes \$1.349 billion for development of the Space Shuttle as requested. Major additions made by the committee include \$7 million to initiate go-ahead for a Lunar Polar Orbiter, \$5 million for studies for Space Industrialization and \$5 million for studies of a Solar Power Satellite. (Defense/Space Business Daily, Vol. 91 No. 14, March 18, 1977.)

**March 21:** In mid-1976 NASA completed a study on how to most effectively carry out the space program over the next five years. Accordingly, NASA's annual budget should be increased from 4.1 billion in FY-78 to 4.7 billion (in FY-78 dollars) by FY-82. Under the plan, three programs were slated for major increases: space industrialization -- the construction of space bases for



manufacturing and solar power development; space science, including exploration of the solar system; and space applications. Funding for space industrialization would increase from \$15 million in FY-78 to \$580 million in FY-82; for space science, from \$466 million to \$947 million; and, for applications, from \$225 million to \$420 million. Research and Program Management funding would remain constant at \$818 million. (Defense/Space Business Daily, Vol. 91, No. 15, March 21, 1977.)

March 29: House HUD-Independent Agencies Appropriations Subcommittee chairman, Representative Edward P. Poland, presented an interim report by an Appropriations committee investigation unit. The report cited a number of questions about the Space Shuttle program which the investigating unit considered as unanswered or only partially answered by NASA concerning user requirements, user charges, environmental problems, the adequacy of the testing program, Spacelab development schedule, and the need for a fleet of five Orbiters. Two of NASA's most critical projects in the FY-78 budget -- production of the fourth and fifth Orbiters and the development of the Space Telescope--were the subjects of numerous questions passed to Dr. James Fletcher, NASA Administrator.

In reply Dr. Fletcher pointed out that:

- (1) NASA is projecting a need for 560 flights between 1980-1992, but if there were only 300 flights, five Orbiters would still be the most cost effective number.
- (2) Two Orbiters could conduct an estimated 160 missions, and three 283 missions, during the 1980-92 time period -- this would create the need for continued use of expendable vehicles.
- (3) If there were no military launches, then 3 Orbiters would be enough for NASA missions--but in fact the DOD was planning for 112 Shuttle missions. (Defense/Space Business Daily, Vol. 91, No. 22, Wednesday, March 30, 1977.)

April 1977

**April 1:** NASA's John F. Kennedy Space Center has awarded a \$479,600 contract for mail and distribution support services to the Atlantic Technical Services Corp., 290 Iris Road, Casselberry, Fla.

The one year fixed-price contract, with provision for extensions of two additional years, covers a period from April 1, 1977 through March 31, 1978.

The company provided Spaceport mail and distribution services during earlier contracts extending from April, 1971, through March 31, 1977. (NASA News, Release No. 86-77, April 1, 1977)

**April 4:** Fabrication of the first shuttle external fuel tank was completed by Martin Marietta Corporation. Following testing and further processing the tank will be sent from Michoud to the National Space Technology Laboratory in mid-summer. The first three of the 155 feet long, 28 foot diameter tanks will be used for testing purposes. The external tank system is composed of a 32,000-pound liquid hydrogen tank, a smaller liquid oxygen tank and an inter-tank structure which combines the two tanks. (Defense/Space Daily, Vol. 91, No. 25, Monday, April 4, 1977. p. 198)

**April 5:** Twenty-six KSC employees were honored at the Center's quarterly awards ceremony. The presentations were made by Center Director, Lee R. Scherer and Deputy Director, Miles Ross. The Center's top award, the KSC Certificate of Commendation was presented to: Clifford A. Bethea, Administrative Operations and Support Services; John W. Coonfield, Expendable Vehicles; William P. Deeson and Jim Orr, Support Operations; James A. Devault, Information Systems; Hardie B. Ford and Harold Pyers, Shuttle Projects; and, Ronald H. Gallaway, James H. Lane, Robert D. Luhm, Willie L. Brannon and Donald R. Stubbs, Design Engineering. The Equal Opportunity Award was presented to Ellen Horn of the Shuttle Projects Office and the Woman of the Year award was presented to Faye Nick of Procurement, Supply and Transportation. Length of Service Awards went to: Charles A. Dunn, 40 years; Stephen T. Dunham, Otis Leming, Harlaw C. Powers and William Lohse, 35 years; and, Newton Gregg, Raymond Stinson, William B. Hadwin, Erwin W. Hectman, Autumn Y. Shannon and Angelo Tarami for 30 years of service. (Spaceport News, Vol. 16, No. 8, April 15, 1977)

- o Kennedy Space Center Director Lee R. Scherer announced today the resignation of his Deputy Director, Miles Ross.

Ross has accepted the position of Regional Manager in Europe for TRW Systems International, Inc. He will assume his new duties in early May.

Scherer accepted the resignation with deep regret, noting that "Mike has been a very strong deputy. He has played a vital role in the development of KSC since joining NASA in 1967. His knowledge and background and his good judgment have been invaluable to me in the management of the Center."

Ross was with TRW for 11 years prior to joining NASA. He was project manager of the Air Force Thor and Minuteman missile systems for TRW's Florida Operations at the time he was named Deputy Director for Operations at Kennedy Space Center in 1967. He was appointed to his present position of Deputy Director in 1970. (NASA News, Release No. KSC 88-77, April 5, 1977)

**April 7:** Space Division, Rockwell International Corporation, Downey, California, was awarded a \$95,025,000 cost plus award for contract for that company's participation in the STS program between January 1, 1977 and March 31, 1980. Rockwell will have primary responsibility for the activation of facilities and systems required for the Orbiter and Space Shuttle main Engine processing including systems in the orbiter Processing Facility, Vehicle Assembly Building High Bay 1, Pad A and the Hypergol Maintenance Facility areas. The contract also provides for Orbiter support during checkout, launch and post-flight operations for the first six space shuttle missions. (Spaceport News, Vol. 16, No. 9. April 29, 1977)

**April 12:** KSC has awarded a fixed price contract to Algernon Blair Industrial Contractor, Inc., Norcross, Georgia. The \$4,334,000 dollar contract is for construction of a sound suppression water system designed to protect the Orbiter payloads from damage by reflected acoustical energy associated with its launch. The contract calls for construction of a 300,000-gallon water storage tank and water lines, the installation of solid rocket motor booster side flame deflectors and an electrical control system for the water deluge system at LC-39A. At launch, the water will be released at ignition of the Orbiter engines and solid rocket motor boosters to reduce the overall sound levels reflected back to the Orbiter from the pad structures. (Spaceport News Vol. 16, No. 8, April 15, 1977.)

**April 12-13:** The Solid Rocket Booster (SRB) Project Review was held at KSC. The purpose of this meeting was to review the entire SRB operations. Representatives of KSC Directorates, MSFC, JSC, Headquarters, DOD and contractors participated in the review.

Major problems were identified during the two day meeting:

1. Immediate action is needed to establish the condition of the railroad track between Titusville and the VAB and the schedule and cost for refurbishment. Since the first SRM will arrive at KSC in September 1978, rapid resolution of this problem is required.

2. SRB retrieval planning to date has not provided for storage of the retrieval equipment or a maintenance facility for repair of equipment. Also, permanent berthing facilities for the retrieval vessels has not been included in present designs.

3. Disassembly facility planning has been to design Hangar AF.

- a) Provide SRB transportation from slip into Hangar AF.
- b) Provide rotation of assembled SRB during washing and safing operations.
- c) Provide for disassembly of SRB case-to-case joints.
- d) Provide for installation of end rings (round case).

4. MSFC's planning, to date, has not included funding for expansion of parachute facility and Refurbishment and Subassembly Facility (RSF) to handle the 40 per year launch rate. MSFC will revise their planning and budgeting accordingly.

**April 14:** NASA's John F. Kennedy Space Center has awarded a \$95,025,000 contract to the Space Division, Rockwell International Corporation, Downey, Calif.

The cost plus award fee contract, signed April 7, covers the period from January 1, 1977 through March 31, 1980, and provides for Rockwell participation in activation of Space Shuttle facilities and systems and for Orbiter support during checkout, launch and post-flight operations for the first six Space Shuttle missions.

The contract also provides for Rockwell to support Orbiter post-flight operations at NASA's Dryden Flight Research Center, Edwards, Calif., following landings there. The Orbiter will land at Dryden following each of the first four missions.

Rockwell will have primary responsibility for activation of facilities and systems required for Orbiter and Space Shuttle Main Engine processing, including systems in the Orbiter Processing Facility, Vehicle Assembly Building High Bay 1, Pad A, and Hypergol Maintenance Facility areas.

Additional tasks assigned to Rockwell under the contract are fabrication of hypergol valve complexes and the design, fabrication, installation and activation of Orbiter communications and tracking station checkout equipment in the Orbiter Processing Facility. (NASA News Release No. 92-77, April 14, 1977.)

**April 18:** Mr. W. E. Black, Roadmaster, Florida East Coast Railway, and NASA representatives, inspected all the track from Jay-Jay junction (Titusville) to the KSC Industrial Area on April 18. The inspection revealed weak ties in the Jay-Jay yard, in a 2-mile section east of the Indian River Bridge, and a 2-mile section in the vicinity of the VAB wye. Also noted was the need of additional ballast, switch work required at Wilson Corner, broken bolts at rail joints, and a defective rail approximately 3-miles north of the VAB. Also, the curve approximately 2-miles north of the VAB has too much slope for the high center-of-gravity loads of SRM's.

Mr. Black will recommend in his report, that will be reviewed by FEC top management, that 3,000 ties (2,500 in FEC line, 500 in KSC portion) be replaced, that 40 to 50 cars of ballast be added, that defective bolts and rail be replaced, and that the total line be lined and tamped. Mr. Black stated this work could be completed in one month at approximately \$650K. It remains to be seen if FEC will spend that amount of money.

Mr. Black also stated that all the ties would have to be replaced within 5 years. (Notes to the Center Director--Gray 4/21/77)

**April 19:** NASA's John F. Kennedy Space Center has awarded a contract for \$1,733,000 to the Beckman Construction Co. of Fort Worth, Texas.

The fixed price contract is for the construction of a Space Shuttle Orbiter Mate/Demate Device and miscellaneous projects at the three-mile-long Orbiter Landing Facility at KSC's Launch Complex 39.

The contract calls for the construction of a concrete foundation and erection of the Mate/Demate Device, which will be used to raise and lower the Orbiter from its attachment points atop its 747 carrier aircraft.

The device is a basic steel structure 100 feet high, 110 feet long, and 100 feet wide.

It will be located on the northeast corner of the Orbiter Landing Facility's ramp area.

Other work under the contract consists of construction of a 40,000 square foot ground support equipment parking area and access road, foundation pad and apron for the precision laser tracking system, five weather sites, concrete pavement around the 21 elevated approach lights at each end of the runway, installation of four fire water suction lines, and associated work.

Completion of the work is scheduled for 360 calendar days. (NASA News Release No. 95-77, April 19, 1977.)

**April 20-27:** The first geosynchronous scientific satellite developed by the European Space Agency was launched aboard Delta 130 at 5:15 a.m. EST from Launch Complex 17B. The Delta mission was to place the spacecraft in an elliptical transfer orbit with an apogee of 35,785 kms and a perigee of 231.6 kms. However, apparently the 2nd/3rd stage clamphand opened prematurely due to failure of one of the clamphand's explosive bolts during the second stage coast flight. Subsequent activation of the spin table failed to spin up the 3rd stage/spacecraft combination and broke the electrical harness connecting the stages. The third stage did fire however, and for the planned duration, but was improperly oriented and without effective spin stabilization. On April 27, the apogee kick motor was fired which sent the spacecraft in an elliptical orbit of 70,365 kms apogee and 1215 kms perigee. Delta 130 was the first failure of the Delta in over 3 years. The satellite is operating successfully although it is fulfilling only a portion of its mission. (Pre-launch Mission Operations Report, No. M-492-302-77-01, April 13, 1977; and, Post Launch Mission Operations Report No. M-492-302-77-01, August 10, 1977. Also, Spaceport News, Vol. 16, No. 9, April 24, 1977.)

**April 21:** President Carter is expected to nominate a former deputy director of the Pentagon's Advanced Research Projects Agency as the next Administrator of the National Aeronautics and Space Administration.

Robert A. Frosch, Deputy Director of the Woods Hole Oceanographic Institution met with the President last week in the White House and his appointment to the NASA post is anticipated shortly.

Frosch, 49, served as ARPA's deputy director from 1965 until 1968, when he was named the Assistant Secretary of the Navy for Research and Development. He was also the Deputy Director of the United Nations Environmental Program before taking the Woods Hole post in 1975. He has a PhD in physics from Columbia University.

- o The National Space Institute will hold a banquet in Dallas on May 7 to honor Dr. Wernher von Braun, the father of the United States lunar landing rocket program. Von Braun, who is hospitalized with cancer, will not be able to attend the gathering.

The proceeds from the \$200 a plate affair will be used for educational programs of the institute, a non-profit educational and scientific organization conceived by former officers of the National Space Club to promote the development of space technology. Von Braun was the first president of the institute and is now chairman of the board.

- o India has approved the undertaking of a 150 million rupee program for the development of an experimental communications satellite by the Indian Space Research Organization. The satellite, identified as "Apple," will be launched with the French Ariane rocket about the middle of 1980. The director of the center, U.R. Rao, said the Apple satellite will be the forerunner of India's communications satellite program.
- o The Soviet Union launched Cosmos 904 into orbit from Plesetsk on April 20 with a mission oriented toward military reconnaissance/surveillance. The spacecraft was put into an orbit of 210/350 km, 71.4 deg, 89.8 min.

Cosmos 904 is the Soviets 22nd space mission for 1977, three missions below the rate set last year by the USSR. It is also the 8th recon/survey mission of the year (the 374th since 1962); the 1001st space mission by the Soviets; the 16th military mission of the year (642 military missions total); and the 20th mission from Plesetsk this year.

The hiatus of space missions from Baikonour Cosmodrome near Tyuratam continues to grow, and has now reached an usual length of 72 days, since the launch of Soyuz 24 on Feb. 7. Such a delay would usually foreshadow a major mission, such as another manned flight.

- o The Voyager 2 spacecraft is scheduled to leave the Jet Propulsion Laboratory today for its trip to Cape Canaveral where it will be launched this summer to the outer planets. It is scheduled for launch on August 20 aboard a Martin Marietta Titan-Centaur launch vehicle.
- o In a recent speech to the Explorers Club, Rockwell International chairman W. F. Rockwell Jr. cited the possibility in the future of orbiting as many as 100 Solar Power Satellites, each on the magnitude of 16 miles long and one mile across.

"Looking 30 to 40 years beyond Solar Power Satellites," Rockwell said, "continued development of space could yield even greater benefits" in the energy area.

He said that scientists looking at what might be possible beyond the year 2040, speculate about reflecting surfaces covering 40,000 square kilometers, larger than the combined areas of Rhode Island, Massachusetts and Connecticut. He said these surfaces, "acting as miniature Suns, would reflect high

concentrations of sunlight to provide enhanced photosynthesis of critical crops or ocean fish farms."

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- o A 32-month study funded by NASA has suggested that the simplest, safest and cheapest way of retrieving satellites in orbit is to spray them with water, which, in turning from ice to water vapor, will eliminate the spinning of the satellite which now makes it difficult to recover spacecraft.

The study was conducted by Dr. Marshall Kaplan, a Pennsylvania State University aerospace engineer who has been working on space retrieval problems for seven years.

Kaplan pointed out that the biggest obstacle in capturing objects in space is the fact that many of them are spinning or tumbling very quickly, making it unsafe for the retrieval vehicle to link up with the target--"particularly if there are people in either object."

He said that other proposals suggested for de-spinning satellites in space involve massive, expensive equipment and a highly intricate, perhaps dangerous operation.

His concept would involve a specially-designed space vehicle, carrying a large payload of water, which would point a nozzle at the spinning satellite and spray it with the water. Although much of the water will not reach the target, he said, enough of it will form a layer of ice--which will absorb much of the spin. As the ice changes to gas, over a period of a few minutes to two hours, the remainder of the spin will be eliminated.



When the object has slowed down sufficiently, a Space Shuttle manipulator will be able to dock with it and retrieve it.

Because the size of the target will determine the amount of water needed, Kaplan said his technique could not be used on objects weighing more than 1760 pounds, because the spray vehicle would not carry enough water.

He has recommended to NASA that his concept be tested in the Space Shuttle program.

- o General Electric's Space Division has urged NASA to utilize a GE-built Payload Orientation and Instrument Tracking System (POINTS), which was developed for the cancelled Skylab-B program and placed in storage several years ago, for early Space Shuttle flights.

GE said that the POINTS system could be readied for use as a small instrument pointing system as early as the fourth Shuttle operational flight test at a cost of \$1 to \$1.5 million. It said this would require fabrication of drive electronics and some minor structural modifications to make POINTS compatible with the shuttle's pallet structure. The company said it would cost some \$6 million to design and build an entirely new pointing system.

The all-beryllium, state-of-the-art POINTS system is 70 inches tall and 95 inches wide, and is designed to support 1500 pounds of instrumentation. With external sensors, pointing accuracies on the order of one-arc-second are possible, GE said.

The company said the system, originally developed under contract from NASA-Johnson represents \$20 million of R&D work.

- o Fabrication and installation of a tail service mast for transfer of propellants, pressurization fluids and electrical power between the Space Shuttle Orbiter and the Mobile Launcher Platform is called for in a Kennedy Space Center IFB. Bid opening May 11. (Defense/Space Business Daily, Vol. 91., No. 38, Thursday, April 21, 1977.)

MAY 1977

May 1: Dr. James C. Fletcher, NASA Administrator since 1971, resigned his position effective this date. Dr. Fletcher spoke of NASA's future on leaving office.

"When people see the Space Shuttle actually building things in space," he said, "things such as communications antennas, space stations and solar power plants, I'm confident that you will see increased support."

And he added, "You're going to see a space station, a lunar base and a manned Mars mission, perhaps sooner than you expect."

The latter three are programs that, during Fletcher's tenure, have been kept on NASA's back burner because they are too expensive to hope for presidential or congressional support.

Lack of support--and lack of money--have been NASA's big problems for all six of Fletcher's years as administrator. He has had the thankless job of keeping the agency moving forward in spite of a shrinking budget and the squeeze of inflation.

To do it, he took steps that made him unpopular both with some scientists and with some people in NASA. A major one was his killing of the Grand Tour in 1972.

The Grand Tour was to have been an unmanned probe of the five outer planets --Jupiter, Saturn, Uranus, Neptune and Pluto. The five are now all on the same side of the Sun, a lineup that will not recur for 79 years, and this offered a rare chance to map and study all of them with a single "fly-by" spacecraft.

"I regret giving up the Grand Tour," Fletcher said in an interview this week. "It is one of my major regrets. But it had to be in the 1973 budget if it was going to go at all. We had to get the Shuttle started too, and we could only win on one." (TODAY, Monday, May 9, 1973.)

May 9-11: A Waste Heat Management and Utilization Conference was held at KSC on May 9-11. Interest and attendance at this conference, which was sponsored by NASA, EPA, NRC, and two power companies, exceeded expectations. Researchers from all over U. S. , Europe, and Japan attended.

Power plants employing either fossil or nuclear fuels convert only about one third of the fuel to electricity; the rest is wasted. A lot of good research has been done both to increase the conversion efficiency and to utilize the waste heat for other applications such as agriculture and aquaculture.

KSC interest revolves around work with the University of Miami developing a three-dimensional model which could help shorten the time now required for environmental assessment by providing a toll acceptable to the regulatory agencies. While at Miami a conference was held with representatives from EPA, NRC, and NASA Headquarters to discuss an ASVT demonstration project in FY 78. At this stage, indications are encouraging for conducting a jointly funded project. (Notes to the Center Director -- Claybourne 5/12/77)

May 12: NASA's John F. Kennedy Space Center has awarded a contract for \$3,116,000 to the Beckman Construction Co., Fort Worth, Texas.

The fixed price contract, to be completed within 350 calendar days, is for work on the Orbiter Processing Facility (OPF) in which Space Shuttle orbiters will be serviced after their return from flights in space.

The contract calls for fabricating and installing the main access platform, piping and cabling in one of the OPF's two high bays and construction of a two-story, 10,000-square-foot Service and Support Annex.

Work under this contract is part of a comprehensive reshaping of KSC's Launch Complex 39 for its new role as the prime launch and recovery site for the reusable Space Shuttle, which will begin Earth orbital flights in the spring of 1979.

The Orbiter, about the size of a medium-range jet transport aircraft, will land on a three-mile-long runway to the northeast of the Vehicle Assembly Building.

It will then be moved into the OPF for the removal of ordnance, payloads and residual fuels. After servicing, it will then be moved into the Vehicle Assembly Building for mating with its solid rocket boosters and external propellant tank in preparation for its next mission in space. (NASA News Release No. KSC 102-77, May 12, 1977.)

- o The bid opening for sale of the MSS was held at 10 a.m. on May 12 at the GSA Personal Property Office on State Road 3. Twelve bids were received ranging from a low negative bid of \$1,000,000 to a high positive bid of \$30,000. All negative bids have been declared non-responsive by GSA and bidders have been notified. The three top bidders and their bids are:

Charles Giguere and W. J. Evans, San Jose, California - \$30,000  
National Wrecking Company, Chicago, Illinois - \$16,000  
Cayuga Wrecking Company, Opa Locka, Florida - \$12,000

GSA has requested information from the apparent successful bidders in order to begin Anti-Trust Clearance. Also requested were the "tear-down" and "safety" plans. These are expected around June 1.

**May 17:** The National Aeronautics and Space Administration has selected Computer Sciences Corp., (CSC) Falls Church, VA., for the award of a contract for communications and instrumentation support services at the John F. Kennedy Space Center, Fla. RCA is expected to be a major subcontractor to CSC.

Kennedy Space Center is NASA's launch site for the Delta, Atlas and Titan/Centaur expendable launch vehicles and will be the major launch site for the Space Shuttle manned flights scheduled to begin in 1979.

Services to be performed embrace two separate categories. The first category, covering a three year period, is for the modification, installation, operation, and maintenance of the operational intercommunications systems, the operational television system, and the checkout, control, and monitor subsystem.

The second category, covering one year with options for two additional years, is for communications, measurements, telemetrics, computer services, data storage and retrieval, program planning, and reliability and quality assurance. Most of the work will be accomplished at the Kennedy Space Center.

The value for the first three years of the cost-plus-award-fee contract beginning June 1, 1977, is approximately \$41 million. (NASA News Release No. KSC 104-77, May 17, 1977)

**May 18:** On May 18, 1977, at approximately 7:30 a.m., the Number 1 Caster IV Solid Motor on Delta 132 fell from the launch vehicle to the launch deck. The mishap occurred before pad personnel started work so there were no personnel injuries involved. The 23,300-pound motor fell about 12 feet before the aft end of the motor became wedged between a test stand structural member and the launcher flame deflector. The nose cone of the motor penetrated the first stage L02 tank, opening a crack about three feet in length. Because of the precarious position of the motor, immediate safing operations have been limited to attaching a holding line to the forward end to prevent further falling. Studies are under way on the safest method to remove the motor. Preliminary assessment of the vehicle damage indicates .

that the entire vehicle will have to be dismantled to facilitate external repair to the LO2 tank. Investigations into the exact cause of the mishap and precautions necessary to prevent any additional motor attachment failure are under way.

May 19: Richard Bendura and a team of 12 scientists from Langley visited KSC last week to fly detection missions for booster exhaust effluent in conjunction with the Titan launch. VO supported this mission and the MSFC cloud model was run on our local computer and provided accurate predictive data on the diffusion characteristics (movement, altitude, dispersion, concentrations) of the exhaust cloud. The Langley aircraft made a number of passes through the cloud before losing it in the low ceiling at T + 15-20 minutes. Preliminary indications are that HCI concentrations were in the 5 to 6 ppm range.

Mr. Carl Sandahl, a member of the Investigative and Survey Staff for the House Appropriations Subcommittee, viewed the launch and accompanied ground based observers to monitor the exhaust cloud travel. Indications are that his concern is much diminished as regards public reactions and the degree of danger to surrounding areas outside KSC boundaries. More definitive data will be available following Langley data reduction.

May 23: Rockwell International's cost-plus-award-fee contract with NASA for design, development, test and evaluation of the Space Shuttle Orbiter vehicle is now valued at an estimated \$3,042,181,353. The latest addition to the contract was a \$3.1 million supplement awarded last month for design changes in the Orbiter's airlock and tunnel, which provides a shirtsleeve environment for movement of crewmen between the Orbiter and the Spacelab in the Orbiter's cargo bay. (Defense/Space Business Daily, Vol. 92, No. 16, Monday, May 23, 1977.)

May 26. The International Telecommunications Satellite Organization's third Intelsat IV-A (F-4) was successfully launched aboard an Atlas-Centaur space vehicle from Launch Complex 36A at 5:47 p.m. EDT. The Atlas booster and the first burn of the Centaur stage placed the vehicle in an elliptical parking orbit with an apogee and a perigee of 975 and 102 nautical miles, respectively. Later, a second burn of the Centaur stage injected the vehicle into an elliptical transfer orbit with an apogee of 35,938.3 kms and a perigee of 548.8 kms. The spacecraft's apogee kick motor was fired successfully by the COMSAT launch team on May 27, to boost the spacecraft into an equatorial orbit over the Western Pacific Ocean. An eastward drift of the satellite will subsequently place it in a synchronous equatorial orbit over the Atlantic Ocean. (Launch Mission Summary, Intelsat IV-A (F-4) Atlas/Centaur-39, KSC, NASA, May 26, 1977. Post Launch Report, Mission Operations Report, No. E-491-633-77-03, August 30, 1977.)

- o NASA's John F. Kennedy Space Center has awarded a \$25,720,364 contract extension for engineering support services to Planning Research Corporation, McLean, VA.

The 12-month cost plus award fee contract extension provides for Planning Research Corporation to continue design engineering support services for the Space Shuttle program, and other activities for which KSC's Design Engineering Directorate has design responsibilities, from May 20, 1977 through May 19, 1978.

Work is performed at the Kennedy Space Center and Cape Canaveral Air Force Station in Florida, at KSC's Western Launch Operations Division, Vandenberg AFB, and NASA's Dryden Flight Research Center, Edwards AFB in California.

The contract extension brings the total amount of the contract, originally awarded on May 20, 1974, to \$72,616,061. The company employs more than 1,100 persons at KSC. (NASA News Release No. KSC 111-77, May 26, 1977.)

- o The on-pad separation of the number one solid motor from the first stage of the Delta 132 OTS launch vehicle has been attributed to the failure of one of the studs used in the solid motor separation clamp assembly. The two studs and the frangible nut from that assembly were recovered and are presently undergoing extensive metallurgical and structural analysis in an effort to determine the exact reason for the failure. Disassembly of the launch vehicle is proceeding with the second stage scheduled to be removed first, followed by the eight solid motors still on the vehicle, before an attempt is made to move the damaged solid motor. The launch vehicle will be returned to Huntington Beach for replacement of the first stage L02 tank.

Preliminary rescheduled discussions for the OTS mission indicate the possibility of a September 1977 launch date. If this date materializes, the OTS spacecraft will remain at KSC pending reinitiation of checkout operations.

- o The USCSC reported that minority employees made significant gains in the total Federal workforce. They increased to 21.1% of the total Federal workforce. Minorities had gained 2,801 jobs by May 1976. Minorities also made net gains in higher grades and salaries. Those holding jobs that paid over \$20,000 a year (GS-12 and above) increased by 15% between May 1975 and May 1976 according to the USCSC. Minorities also made net gains in higher grades and salaries. Those holding jobs that paid over \$20,000 a year (GS-12 and above) increased by 15% between May 1975 and May 1976 according to the USCSC. Minorities now account for 7.1% of the top civil servant jobs, a 1.6% increase over 1973. Commission data is normally one year old when reported.

May 31: Responsibility for developing national policy on weather modification resides with the Secretary of Commerce, who appointed a Weather Modification Advisory Board to develop recommendations. At a meeting of the board on May 31, 1977, Dr. Morris Tepper, NASA Headquarters, provided the NASA input on related meteorological research. He selected and presented slides prepared here on the KSC lightning research program, which he considered one of NASA's significant contributions. (Notes to the Center Director--Claybourne (6/4/77.)

## JUNE 1977

**June 1:** NASA's John F. Kennedy Space Center has awarded a \$480,193 fixed-price contract to Reynolds, Smith and Hills, Architects, Engineers, Planners, Inc., 4019 Boulevard Center Drive, Jacksonville, Florida. The contract, extending from June 1, 1977 through November 28, 1977, provides for the architectengineering firm to prepare specifications and drawings for modification of Complex 39B to adapt it for space Shuttle launch operations. The modification will result in a configuration of the launch pad and complex facilities (called the Rotating Service Structure and Fixed Service Structure similar to that of Complex 39A, where modifications are underway. Construction of complex 39B, second of two Apollo/Saturn launch facilities, was completed in late 1967. Apollo 10 was launched from the complex as were the manned Skylab 2, 3, and 4 missions and the U.S. spacecraft of the Apollo Soyuz Test Project. (NASA News Release No. KSC 125-77, July 1, 1977.)

**June 2:** NASA has selected Boeing Services International, Inc., Seattle, Wash., a wholly-owned subsidiary of Boeing Aerospace Corp., for final negotiations leading to the award of a cost-plus-award-fee contract to provide ground systems operations in support of NASA launch operations under the management of the Kennedy Space Center, Fla.

Boeing also will provide some support to Air Force Operations at the Air Force Eastern test range and Cape Canaveral Air Force Station, Fla.

The Kennedy Space Center is NASA's East Coast launch site for expendable launch vehicles (Delta and Atlas) and the Space Shuttle, scheduled to be launched in 1979.

Services to be performed, beginning July 1, 1977, consist primarily of the operation and maintenance of launch systems and facilities. The contractor's estimate of the contract value for the first three years, including the maximum award fee, is approximately \$80,500,000.

Bendix Launch Support Division of Bendix Aerospace Electronics Group, Arlington, Va., was also a bidder. (NASA News Release No. 77-115, June 2, 1977.)

**June 6:** The gantry on LC-19, rendered unsafe by rust and corrosion, was toppled by explosive charges. Originally built for the research and development



testing of the Titan II ICBM, the complex was modified for the Gemini program. All Titan-Gemini launches were made from this complex.

The Headquarters call for the FY 79 R&PM Budget was received and a telecon concerning "Zero Base Budgeting" was held on 6/6/77. Our call was issued 6/9/77. The due date in Headquarters is 7/11/77 and the budget will be done as a Zero Base exercise. Due to the shortage of time, most of the work on the Zero Base Current level, which is the decision package to the Headquarters mark, will be done in-house by AM. The directorates will be asked to supply the required data for additional funding requirements, which will be consolidated into what is termed "Augmentation Packages." (Notes to the Center Director--Malaga, 6/9/77)

**June 7:** NASA's John F. Kennedy Space Center has awarded a one-year \$1,368,713 contract extension for operation of component refurbishment and chemical laboratories to Management Services Incorporated, Huntsville, Ala.

The one-year extension covers the period from June 1, 1977, through May 31, 1978. The cost-plus-fixed fee contract is a set aside for small businesses.

The \$1,368,713 extension brings the value of the basic contract with Management Services Inc., to \$2,538,713 since the original contract award on June 1, 1976. (NASA News Release No. KSC 116-77, June 7, 1977.)

**June 8:** The following "possible candidates for the future high-priority mission opportunities" in the NASA lunar and planetary exploratory program were outlined last week by A. Thomas Young, director of lunar and planetary programs for NASA:

- \* The 1982 Jupiter Orbiter Probe (JOP) mission, which has been requested as a new start in FY '78.

- \* A mission in 1982 to rendezvous with Halley's comet.

- \* A mission in 1983 to orbit Venus and map its surface with advanced imaging radar.

- \* The launch in 1984 of two Mars Roving vehicles.

- \* A spacecraft to be launched in 1985 to orbit Saturn and launch two probes--one to study the planet's atmosphere and one to examine the atmosphere of Saturn's moon, Titan.

- \* A probe to be launched in 1985 to survey the 240-mile-diameter asteroid Vesta, and three smaller asteroids.

\* A spacecraft for launch in 1986 to orbit Mercury and possibly land a simple exploratory robot on the surface of the planet.

\* A 1990 launch of automated satellites to land on Mars, collect samples and return them to Earth. (Defense/Space Business Daily, Vol. 92, No. 27, Wednesday, June 8, 1977.)

**June 10:** NASA's John F. Kennedy Space Center has awarded a one-year, \$1,567,954 contract to the Aerospace Services Division, Pan American World Airways, Inc., Cocoa Beach, Fla., to provide occupational medicine and environmental health services.

The contract, which extends from July 1, 1977 through June 30, 1978, has options for four one-year extensions that would bring total contract value to approximately \$10,000,000.

Under the contract, Pan American will provide occupational medicine and environmental health services for civil service, military and contractor personnel, supporting both NASA's Kennedy Space Center and Cape Canaveral Air Force Station. Services are performed by physicians, medical technicians and nurses.

Pan American, which has provided occupational medicine and environmental health services at KSC and Cape Canaveral under an existing contract since 1971, was the only company responding to NASA's request for proposal. (NASA News Release No. KSC 118-77, June 10, 1977.)

**June 13:** NASA's John F. Kennedy Space Center has awarded a contract for \$696,410 to the Belko Steel Corporation, Orlando, Fla.

The contract is for the fabrication, assembly and fit-check of two tail service masts for a Mobile Launcher Platform from which the Space Shuttle will be launched beginning in 1979.

The masts are 32 feet tall and are the mechanisms which will be used to retract the liquid oxygen and liquid hydrogen umbilicals from the Shuttle at the zero point in the final countdown.

The masts are to be located on the zero or launch level of the Mobile Launcher Platform.

The tail service masts are to be delivered to KSC's Launch Equipment Test Facility in December for testing prior to installation on the Mobile Launcher Platform. (NASA News Release No. KSC 119-77, June 13, 1977.)

**June 14:** The ocean testing of the prototype SRB Dewatering Set was accomplished during the time period May 31, 1977 through June 14, 1977. The actual acceptance testing was successfully accomplished on June 13 and 14, 1977.

The tests successfully demonstrated the capability of the SRB Dewatering Set to perform its intended function, i.e., dock and lock in the SRB Nozzle, Dewater the SRB, Seal the SRB Nozzle and maintain the SRB in a Log Mode. Some minor malfunctions occurred during the test, but had no major impact.

Many problems were encountered from May 31, 1977 through June 9, 1977, which prohibited the testing from being accomplished earlier. Most of these were minor in nature and many were caused by technician errors when reassembling the Nozzle Plug following a repair job.

Some minor changes to the production units design will be made as a result of problems occurring during the ocean testing. The major concern left open is variable buoyancy of the nozzle plug. At present, external pressure applied as the nozzle plug dives forces air out of the sealing bag and also out of the umbilical air hose, causing a loss of flotation and resulting in a neutrally buoyant nozzle plug at depth. If the umbilical is severed while the nozzle plug is at depth, it could be lost. NOSC (Naval Ocean Systems Center) is assessing this problem. (Notes to the Center Director--Gray, 6/23/77)

**June 15:** The father of the rocket systems which put the United States into space and the first men on the Moon, Dr. Wernher von Braun, 65, died of cancer in an Alexandria, Virginia, hospital, after a long illness. He was buried on Thursday, June 16, but the news of his death was withheld until after the family had left the area on Friday.

Not only was von Braun the mastermind of the Redstone-based rocket system which put America's first satellite into orbit on Jan. 31, 1958, and the Saturn rocket system which put the first men on the Moon on July 20, 1969, he also engineered the German V-2 rocket systems which were fired into London and ushered in the age of the strategic missile system.

He was born Wernher Freiherr (Baron) von Braun in Wirsitz in Posen province, East Prussia, on March 23, 1912. He became interested in rocketry in the 1920's, when Dr. Robert H. Goddard was pioneering space travel experiments in

the United States, and joined Dr. Walter R. Dornberger in the mid-1930's in the development of Germany's rocket program. (Defense/Space Daily, Vol. 92, No. 35, Monday, June 20, 1977.)

**June 16:** Dr. Robert A. Frosch was confirmed by the Senate as NASA's new Administrator. Frosch replaces Dr. James C. Fletcher who resigned that position on May 1.

- o GOES-2, the second Geostationary Operational Environmental Satellite, was launched aboard Delta 131 from LC-17B at 6:51 a.m. EDT. Performance of the launch vehicle was nominal; the spacecraft was placed in the desired transfer orbit of 36,859 km apogee and 188.6 km perigee. At 11:26 pm the same day the kick motor was fired which injected the spacecraft into a geostationary orbit over the equator at approximately 72.3 degrees west longitude. During its operational checkout period its position will be adjusted to 75 degrees west. Following the checkout period the spacecraft will be turned over to the National Oceanic and Atmospheric Administration for operations.

Instruments aboard the satellite will let it "see" the development of hurricanes in the tropical Atlantic or Caribbean and follow any storm's movement. The satellite routinely transmits imagery back to Earth every half hour, day and night; more frequently when necessary.

GOES-B tentatively is expected to replace an earlier spacecraft of the same series in maintaining the East Coast watch. Another satellite of the series (GOES-1) is positioned above the equator over the Pacific Ocean, watching the western half of the United States and the Pacific as far west as Hawaii.

While hurricane watch is an important mission of the satellite, it is far from the only responsibility, according to David S. Johnson, Director of NOAA's National Environmental Satellite Service.

Originally conceived as weather satellites, the geostationary spacecraft do provide a host of data of importance to weather forecasters. They use both visual and infrared imagery for severe storm evaluation and to analyze cloud cover, winds, ocean currents, fog distribution, storm circulation, snow melt and other environmental phenomena.

But other instruments on board enable the satellite to receive and transmit to earth information from data collection platforms on land and in the oceans; such information as water levels in rivers and reservoirs, ocean wave heights, rain and snowfall measurements, and the like. Additionally, from digital data provided by the satellite, scientists are able to determine wind speeds and directions, and cloud heights. Instruments also monitor solar "storms" by measuring X-rays and high energy particles emitted by the sun.

(Prelaunch Mission Operation Report, No. E-608-77-04, May 24, 1977. Post Launch, Mission Operations Report No. 1, No. E-608-77-05, June 20, 1977. Also NASA News Release No. KSC 113-77, June 6, 1977.)

**June 20:** NASA's John F. Kennedy Space Center has awarded a supplemental contract for Space Shuttle development support to the IBM Corporation Federal Systems Division's Command and Space Systems Center, 18100 Frederick Pike, Gaithersburg, Maryland.

The total value of the two year supplemental agreement covering the period from April 1, 1977 through March 31, 1979, is \$13,334,358, bringing the total contract value since the original award on May 13, 1974, to \$23,104,231.

The contract provides for support to the Kennedy Space Center in development of computer programs of the Launch Processing System for Space Shuttle operations.

Work to be performed is primarily at the Spaceport, with limited supplemental work at IBM facilities in Oswego, New York, Gaithersburg, Maryland and Huntsville, Alabama, and at the Marshall Space Flight Center, where computer programs for Rocket Booster Electrical and Instrumentation Verification Test facilities are being developed. (NASA News Release No. KSC 121-77, June 20, 1977.)

**June 21:** The House last week approved the FY '78 HUD-IA appropriations bill which includes \$3,948,540,000 for NASA, \$29.549 million below the Administration request.

The most significant actions in the bill for NASA are the deletion of the \$20.7 million requested to initiate the Jupiter Orbiter Probe and the deferral of \$56.7 million for production of the fourth and fifth Space Shuttle Orbiters--funding reinstated by the Senate HUD-IA Subcommittee, which must now go to conference.

The chairman of the House HUD-IA Subcommittee, Rep. Edward P. Boland (D-Mass.), explained that the Shuttle funding is being deferred pending the final report of a House staff study on the current status of the Shuttle.

"I want to make clear that this deferral of funding for Orbiter production is one without prejudice," he said. "The committee supports a full five-Orbiter Shuttle fleet. In fact, it is unlikely that a three-Orbiter concept would be economically viable in that such a fleet could not assure launch capability

to all users from both the Western and Eastern Test Ranges."

In passing the bill, the House rejected an amendment by Rep. Ted Weiss (D-N.Y.) to delete the \$15.2 million contained in the NASA appropriation for SST research.

The HUD-IA bill approved by the House also includes \$843.93 million for the National Science Foundation, \$41.07 million below the Administration's request. (Defense/Space Business Daily, Vol. 92, No. 36, Tuesday, June 21, 1977.)

- o The Senate Appropriations Committee, after cutting \$5 million from NASA's R&PM account in line with President Carter's newly-announced reduction in agency personnel, Tuesday approved a \$4,015,927,000 FY '78 appropriation for NASA, \$18.862 million below the amount requested.

The committee bill, once passed by the full Senate, will have to be compromised with a House-passed NASA appropriation which totals \$3,948,540,000--plus \$56.7 million in deferred funds for production of the fourth and fifth Space Shuttle Orbiters--or \$29.549 million below the amount requested.

In addition to the Shuttle production deferral, which was made without prejudice, the major difference in the two bills is the \$20.7 million deleted by the House for the new Jupiter Orbiter Probe mission.

Other differences in the two bills are additions by the House of \$5 million each for Solar Power Satellite and Space Industrialization research, and a reduction of \$7 million in expendable launch vehicles--differences also contained in the House and Senate authorization bills for which a compromise has been reached.

The Jupiter Orbiter Probe mission was approved by both the House and Senate in the NASA authorization, as was full funding of \$1.354 billion for the Space Shuttle. (Defense/Space Business Daily, Vol. 92, No. 38, Thursday, June 23, 1977.)

**June 27:** G. W. Hoffler, M.D., reported for duty June 27, 1977, to the KSC Biomedical Office as Deputy Director by transfer from the Johnson Space Center. His former work there in the Space and Life Sciences Directorate encompassed various aspects of cardiovascular research and related medical evaluations of space crews since the beginning of the Apollo Program flights in 1968. He is trained in internal medicine and is board certified in aerospace medicine. He will assist Dr. Buchanan and staff in planning and implementing medical support for Shuttle operations, in management of occupational health

services, and in conduct of cardiovascular stress testing at KSC. (Notes to the Center Director--Buchanan, 6/30/77)

JULY 1977

July 1: Last summer, leading meteorologists and atmospheric physicists from across the United States and abroad converged on NASA's John F. Kennedy Space Center for the most extensive study on the electrical characteristics of thunderstorms that has ever been conducted. Now, the Center is host to the researchers for the second consecutive year. The 1976 program resulted in the accumulation of a wealth of new data which help explain the phenomena that cause electrical charges in cumulo-nimbus cloud formations, electrical discharges within and between clouds, and from clouds to earth's surface. In addition, the 1976 program laid the foundation for subsequent studies here this summer and in 1978. The world's leading experts on thunderstorms are again gathering at KSC for "TRIP 77" (Thunderstorm Research International Program 1977), and will remain through August 15 to continue their research on lightning and thunderstorms and the hazards they provide. Twenty-one principal investigators with their associates, representing many of the country's leading educational institutions and research organizations, will be involved in the study during the summer. A total of over 85 experimenters will be participating. The planned experiments cover almost every imaginable subject of study. They include electric field measurements of discharges within storm clouds, study of the relationship between electric fields at the earth's surface and those within active thunderclouds, location of the lightning charge "center" and its correlation with the storm's physical structure, measurement of the waveshapes of lightning strokes, determination of the electrical inflow and outflow of clouds, measurement of lightning stroke velocities near the ground with their corresponding electric and magnetic fields, study of the overall evolution of lightning activity at KSC, and establishing the correlation between airborne and ground lightning test measurements. (NASA News Release No. 127-77, July 1, 1977.)

- o A \$1,011,994 contract for roads and grounds services at NASA's John F. Kennedy Space Center has been awarded to Expedient Services Inc. of Titusville, FL. The cost plus fixed fee contract covers the period from July 1, 1977, through June 30, 1978, and includes options to extend through June 30, 1980. Services to be provided under the contract include roadway grass mowing and care, landscape maintenance, pest control, and trash pickup and disposal. The contract is one set aside for disadvantaged firms and was awarded by the Small Business Administration of Atlanta, GA, on behalf of the Kennedy Space Center. Work under the new contract was previously accomplished by the Boeing Co. under a base support services contract. (NASA News Release No. 134-77, July 18, 1977.)

NASA's John F. Kennedy Space Center has awarded a contract for \$183,000 to Briel, Rhame, Poynter and Houser Inc., Cocoa Beach, Fla. The fixed price contract, one set aside for small business concerns, is for architect-engineer services for the design of modifications of piping, cabling, and equipment installation for Pad B at KSC's Launch Complex 39.



Pad B is one of two launch pads at Complex 39 originally built for the Saturn V/Apollo. Both are being modified to accommodate the reusable Space Shuttle, scheduled for launch on its first orbital mission in 1979.

Pad A modifications are nearing completion. (NASA News Release No. 139-77, August 2, 1977.)

**July 14:** President Carter has proclaimed the period of July 16 through 24, 1977, as United States Space Observance Week. Last year the Congress passed a joint resolution requesting this action. The proclamation reminds the American people how the ancient urge to explore has taken us into space, where we strive to understand its relevance to life on earth. It calls upon all Americans to reflect upon the purposes, goals and achievements of the space program by appropriate observances. The dates were selected by Congress to coincide with the anniversary of the Apollo 11 mission, but they also include the anniversaries of such achievements as Apollo-Soyuz and the Viking I landing on Mars. (Special Announcement from Robert A. Frosch, Administrator, Subject: United States Space Observance, July 14-24, 1977, d. July 14, 1977.)

- o The party of Mr. & Mrs. Bill Kovalchik, and their two teenage sons, purchased the 11,000,000th NASA Tour Ticket on July 15th. Mr. Kovalchik is a sales representative with Hoechst-Roussel Pharmaceutical Company and the family resides in Youngstown, Ohio. (Notes--7/21/77--Hollinshead.)
- o The Japanese Government's first geosynchronous orbit meteorological satellite, the Geostationary Meteorological Satellite (GMS), was launched on a three-stage Delta 2914 launch vehicle from NASA Launch Complex 17, Pad-B, on the Cape Canaveral Air Force Station. The Delta vehicle injected the spacecraft into an elliptical transfer orbit, with an apogee of 22,776 statute miles (36,655 kilometers), a perigee of 110 statute miles (177 kilometers), and with an angle of inclination of 27.2 degrees crossing the equator. After GMS was injected into the transfer orbit, control passed to the GMS Mission Control Center at Hughes Aircraft Company, El Segundo, California. The Japanese National Space Development Agency's (NASDA) ground station at Okinawa and the NASA Space Tracking and Data Network (STDN) station at Rosman, North Carolina, were used to control the spacecraft. The NASDA ground stations at Ororua Valley, Australia, and Santiago, Chile, provided transfer orbit backup capability. To convert the orbit from elliptical to circular and remove the angle of inclination so that the flight path was aligned with the equator, the GMS controllers fired an on-board solid propellant motor at the third apogee, which placed the spacecraft into a near-synchronous orbit at 129 degrees east longitude. From this position the spacecraft drifted along its orbital path to 140 degrees east longitude, at which point on-board hydrazine-fueled thrusters were fired to place the spacecraft in a stable orbit at its permanent station, almost directly south

of Tokyo. It operates at a synchronous altitude of 22,300 statute miles (36,847 kilometers).

The GMS will participate in the experimental Global Atmospheric Research Program (GARP), which is sponsored by the International Council of Scientific Unions and the World Meteorological Organization. Its mission objectives are observation of cataclysmic events such as hurricanes, typhoons, and regional weather phenomena; day and night observation of regional weather; relay of meteorological observation data from surface collection points (ships, buoys, and weather stations) to the central processing center in Japan; and transmission of processed imaging data for facsimile reproduction at distribution points in the Western Pacific area.

The GMS was designed, developed, and manufactured by the Hughes Aircraft Company under subcontract to Nippon Electric Company, Ltd. of Japan. NASDA is responsible for the satellite's procurement, launch, initial checkout, house-keeping, and station keeping. It is a multifrequency synchronous altitude geostationary meteorological satellite with two primary payloads; a Visible and Infrared Spin Scan Radiometer (VISSR), and a Space Environmental Monitor (SEM). (Launch Mission Summary and Sequence of Events, Japan GMS, John F. Kennedy Space Center, NASA, July 6, 1977. Also, Post Launch Mission Operation Report, No M-492-101-77-10.)

**July 15:** On July 15, 1977, all hardware and personnel involved in the Lightning Triggering Program underwent a full-up demonstration test. The balloon was launched to 1500 feet and 2 rockets were fired to a height of 600 feet. The test successfully demonstrated the readiness of hardware, test procedures, and personnel to begin gathering data on July 18. (Notes--7/21/77--Clark.)

**July 18:** NASA's John F. Kennedy Space Center has awarded a \$499,089, one-year contract extension to Precision Fabricating and Cleaning Inc., Sharpes, Fla. The contract is for the retest, refurbishment and modification of government-owned compressed gas trailers used in connection with launch operations. It is the first extension under a contract for one year with four one-year options and brings the cumulative amount of the contract to \$1,065,089. The contract is one set aside for small business firms. (NASA News, Release No. KSC 132-77, July 18, 1977.)

**July 20:** Mr. Frank E. Crooks and Mr. Eldon Raley of KSC's Shuttle Project Office have been named to a 10-man team of NASA representatives to assist ERNO-VFW-Fokker through critical design reviews of the Spacelab subsystems. VFW-Fokker is the prime contractor and is responsible for final design, test and integration of these subsystems. A third KSC employee, Mr. William

Oyler, who has been assigned to another NASA team assisting ESA, will join Crooks and Raley also as a member of the NASA team. The assignment is expected to last one to two years. (Spaceport News, Vol. 16, No. 20, John F. Kennedy Space Center, September 30, 1977. Also, Defense Space Business Daily, Vol. 93, No. 2, Wednesday, July 6, 1977.)

July 27: NASA's John F. Kennedy Space Center has awarded a contract for \$7,325,000 to Algernon Blair Industrial Contractors Inc., Norcross, Georgia. The fixed price contract is for the conversion of a Saturn/Apollo Mobile Launcher to a Mobile Launcher Platform for operational use in the Space Shuttle program. The conversion work involves removal of the launcher's 400-foot tall umbilical tower and jib crane. A permanent launch tower is being installed at each of KSC's two Shuttle pads at Complex 39, eliminating the need for towers on the Mobile Launcher Platforms. Also entailed in the conversion is replacement of the single exhaust opening in the platform with the three required by the Space Shuttle's main engine and twin solid boosters. The conversion of one of KSC's three Mobile Launchers to a Mobile Launcher Platform is nearing completion and the new contract marks the beginning of modification work on the second. Completion of the conversion process on the second Mobile Launcher is scheduled in 13 months. (NASA News Release No. 138-77, July 28, 1977.)

July 29: GOES-2, the second operational spacecraft of a series of Geostationary Operational Environmental Satellites, was turned over to NOAA for operational use on July 29, 1977, at 1600Z. Since launch on June 16, NASA engineers have successfully completed a planned orbital checkout program to ensure proper operation of the satellite. The satellite was moved to a position over the equator at 66.5 degrees W. longitude, where most of the orbital tests were performed. The orbit inclination is 1 degree and decreasing as planned, which will preserve hydrazine that would otherwise be used for north-south station keeping. It is estimated that over 67 pounds of hydrazine out of an initial loading of 80 pounds is still available for operational use. The primary and redundant S-band and UHF communications subsystems have been tested in low and high power modes, with no discrepancies. The first pictures from the Visible and Infrared Spin Scan Radiometer (VISSR) were received from the satellite on June 26, 1977, and their quality was judged to be excellent. Minor discrepancies were noted in the spacecraft data handling equipment used to transmit signals emanating from Earth-based data collection platforms, and in the X-ray portion of the solar environment monitoring instrument. The data collection anomaly has been identified as interference from VHF equipment which can be turned off during most of the mission. The X-ray instrument anomaly is believed due to cabling faults which produce noise on the output line. Operational data will be obtained; however, additional calibration operations may be required. NOAA has been advised that based on preliminary analysis there are no operating constraints placed on the spacecraft. NOAA's plan for final positioning of the spacecraft is to have GOES-2 replace GOES-1 at 75 degrees W longitude. The mission objectives of GOES-2 have been achieved. Therefore, the GOES-2 mission is certified to

be successful. (Post Launch, Mission Operations Report, No. E-608-77-04,  
Subject: GOES-2 Post Launch Report No. 2.)

AUGUST 1977

**August 12:** Space Shuttle project officials now believe the program of test flights for the spacecraft may be accelerated, with some tests eliminated. Only four of the remaining five free flights may be undertaken. Following the successful five and one-half minute gliding flight of the Enterprise on Friday, August 12, Donald Slayton, flight test manager, said the scheduled August 30 second flight might be pushed ahead and other tests cancelled. Slayton said it was a matter of diminishing returns. Discussing the third free flight scheduled for Sept. 16, and a fourth on Oct. 13, he said that possibly at the end of this series "we will be very confident we will be able to come out of orbit and land safely." Dr. Myron Malkin, director of the overall development and testing of the Space Shuttle, said the Friday flight was a key step. "It removes all those doubts" about how it should fly. We know what we are doing now." Malkin said the first free flight "seems to have established that our understanding of the subsonic aerodynamic qualities are just about exactly what we thought they were." He said the completion of the testing of the Rockwell-Rocketdyne hydrogen-oxygen engines for the Shuttle is one of the biggest milestones still ahead. However, "I think we have turned the corner with the engines," he said, referring to the completion of 2800 seconds of test time during the past two weeks. He noted that the first of the solid propellant rockets that will boost the Shuttle into orbit was successfully tested by Thiokol at its Utah plant last month and that Martin Marietta is scheduled to complete the first of the shuttle propellant tanks at its Louisiana plant on Sept. 9. The first orbital flight model of the Space Shuttle, the second of the five planned, is two months behind schedule and will be delivered to Cape Canaveral in October 1978. However, project officials are still pushing for the March 1979 first orbital flight date. (Defense/Space Business Daily, Vol. 93, No. 31, Tuesday, August 16, 1977.)

- o The HEAO-A is the first in a series of three satellites being launched by Atlas-Centaurs that are designed to: (1) survey and map the entire sky for X-ray energy sources down to a level of about one-millionth of the intensity of the brightest known source, SC0 X-1, and (2) investigate the shape and structure of the galactic and extra-galactic cosmic ray nuclei impinging on the Earth's atmosphere. The specific scientific objectives of the HEAO-A mission are to: (1) map the X-ray and gamma ray sky over the range from 150 electron volts to 10 million electron volts (0.15 keV-10 MeV); (2) measure size and obtain precise location data on X-ray sources in the range from 1 to 15 thousand electron volts (1 keV to 15 keV); (3) determine the contribution of discrete sources to the X-ray background; and (4) determine temporal behavior of X-ray sources. HEAO-A has a design life of 6 months and will scan the celestial sphere by slowly rotating about an axis pointed toward the sun. The orbital parameters are: orbit-circular 436.4 kilometers, inclination of 22.74 degrees, and period 93 minutes. Orbital altitude and consumables such as thruster propellant, are sized to permit operation for up to one year. (Memo to Administrator from S/Associate Administrator for Space Science, Subject: High Energy Astronomy Observatory-A, (HEAO-A), July 29, 1977. Also, Post Launch Mission Operations Report No. S-832-77-01, August 13, 1977.)

**August 15:** NASA's John F. Kennedy Space Center has awarded a contract for \$1,798,000 to the W & J Construction Corporation, Cocoa, FL. The contract is for converting the Operations and Checkout Building in the KSC Industrial Area to a Payload Horizontal Processing Facility for Space Shuttle operations. The Operations and Checkout Building was originally built for assembly and checkout of the Apollo spacecraft which successfully carried out a lunar exploration program in the late 1960s and early 1970s. Conversion work is concentrated in the high bay area. In its new role, the building will be used primarily for processing the Spacelab being built by the European Space Agency for use in the Space Shuttle program. The Spacelab to be carried in the Shuttle Orbiter's cavernous cargo bay is to be flown on its first mission in 1980. The modifications include provisions for integration and checkout stands, staging and refurbishment stands, utilities to support refurbishment and checkout, fire detection and suppression systems, control room floor refurbishment, and long run cabling. Work under the fixed price contract, one which was set aside for a small business firm, is to be completed within 300 calendar days. ( NASA News Release No. 143-77, August 18, 1977.)

**August 20:** The first of two Voyager spacecraft was successfully launched aboard Titan/Centaur-7 from Launch Complex 41 at the Kennedy Space Center on August 20, 1977, at 10:29:45 a.m., EST. The spacecraft is designated Voyager 2 because it will be the second of the two spacecraft to arrive at Jupiter and Saturn. The Titan III E/Centaur/Propulsion Module launch vehicle system placed the spacecraft on a trajectory that would miss the targeted aim point at Jupiter by about 280,000 km, and the time of closest approach would be late by about 44 hours. Two small trajectory correction maneuvers involving a change in velocity of about 13 meters/second are presently planned during October. All Voyager 2 science instruments appear to be functioning normally except for the photopolarimeter. The analyzer wheel of the photopolarimeter does not step properly. Analysis of the problem is continuing. Because of the spacecraft anomalies noted above, the planned near-Earth science sequences were not performed. In-flight calibration of science instruments will be performed during the normal cruise portion of the journey to Jupiter. Also, many of the Voyager instruments will be making observations of the interplanetary environment during the cruise period. Voyager 2 will cross the orbit of Mars in late November 1977. It will travel through the region of the asteroid belt (2.0-3.6 AU) from February through August 1978. Closest approach to Jupiter will be on July 9, 1979. The encounter science observations of Jupiter will begin about 80 days earlier, in April 1979. (Post Launch Mission Operations Report, No. S-802-77-01/02, October 6, 1977.)

**August 25:** The Italian Industrial Oriented Research Satellite (Italy/SIRIO) was launched into a synchronous transfer orbit from the Eastern Test Range at 7:50 p.m., EDT, on August 25, 1977, by a Delta 2914 Vehicle, Mission Number 133. SIRIO is sponsored by the Italian governmental research agency Consiglio Nazionale delle Ricerche (CNR) and developed by several Italian companies managed by Compagnia Industriale Aerospaziale (CIA). The SIRIO

program consists of launching one spacecraft with a telecommunications transponder and a mechanically despun antenna for performing propagation experiments in the 12 GHz (downlink) and 18 GHz (uplink) frequency bands, and narrow band and wide band communications. The experiments will verify the propagation losses on earth paths from the effects of rain, snowfall, fog, etc., and aid in the future dimensioning of earth-space communication links. The system permits measurements of path attenuation, both absolute and differential, within the limits of a band of about 800 MHz for the uplink and of about 550 MHz for the downlink.

Performance of the Delta launch vehicle was nominal and placed the spacecraft and its apogee boost motor (AMB) into the desired transfer orbit. The orbital elements achieved were: apogee 37,670 km, perigee 229.7 km; an inclination of 23.0 degrees. The satellite performed satisfactorily during the transfer orbit, and the ABM was fired successfully at 10:57 a.m. EDT, on August 27, 1977. The satellite has been maneuvered over the South Atlantic to a position at approximately 15 degrees West longitude above the equator. At this time, all subsystem functional checks are complete and satellite status is satisfactory. (Prelaunch Mission Operations Report No. M-492-209-77-01, August 9, 1977. Also Post Launch Mission Operation Report, No. M-492-209-77-01, November 9, 1977.)

## SEPTEMBER 1977

**September 5:** Voyager 1 was successfully launched by a Titan III/Centaur launch vehicle from Kennedy Space Center at 8:56:01 a.m. EDT, September 5, 1977. Trajectory correction maneuvers were performed on September 11 and 13 and the spacecraft entered a standard cruise configuration with all systems operating normally. The launch countdown was very smooth, with no unscheduled holds. During the launch, however, the Titan performance was low (544 feet/second insufficient velocity). Analysis of launch data shows the Titan II stage had a fuel-rich propellant mixture, apparently resulting from restricted oxidizer flow. The Centaur stage was able to compensate for the low velocity by use of propellant reserves and provided the desired parking orbit and final injection conditions. Events proceeded smoothly after the final propulsion burn: all booms and antennas were deployed and locked into position, and both the Sun and the star Canopus were acquired as planned, with none of the attitude control problems that were encountered following the launch of Voyager 2. The initial trajectory of Voyager 1 was within the one-sigma predicted dispersion area at Jupiter. The initial achieved aimpoint at Jupiter would have missed the nominal aimpoint by about 428,999 km, and the time of closest approach would have been late by 28 hours 15.5 minutes. The velocity change during each of the trajectory correction maneuvers (TCM) on September 11 and 13 was about 20 percent less than expected. The total planned for both maneuvers was 15.3 meters/second. The cause is thought to be due to greater than anticipated plume impingement from the four 0.2 lb TCM thrusters. It is believed that the performance of the Voyager 2 TCM thrusters will be similarly affected and proposed means of improving TCM thruster performance are currently being analyzed. Sufficient propellant margin exists to conduct a successful mission for both Voyager spacecraft. Voyager 1 will overtake and pass Voyager 2 in early December 1977 after having crossed the orbit of Mars. Voyager 1 will be within the asteroid belt (2.0-3.6 AU) from January through May of 1978. Spacecraft closest approach to Jupiter will occur March 5, 1979, although encounter science observations will begin much earlier, in December 1978. In summary, Voyager 1 is cruising normally on its way to Jupiter and Saturn. All instruments are performing well. Scientific information on the interplanetary medium is being received daily from both Voyager spacecraft. (Post Launch Mission Operations Report, No. S-802-77-01/02, no date.)

**September 7:** NASA has been requested by the OMB to reduce its Civil Service complement by 500 positions to reach a new agency ceiling of 23,237 permanent positions by the end of FY 1978. This letter informs you of the status of this effort in an agencywide context. Employees at the NASA Centers have already been informed by their Center Directors of the adjustments to be made at their particular Centers.

NASA will take the 500-position reduction on the basis of programmatic considerations. During the past few months, we have been reviewing the



distribution of manpower throughout NASA against our current program commitments and future phasing of program work. On the basis of these reviews, we have tentatively allocated the adjustments for FY 1978 among the Centers as follows:

|  |      |
|--|------|
| Ames Research Center                   | +45  |
| Dryden Flight Research Center          | -30  |
| Goddard Space Flight Center            | -74  |
| Headquarters                           | -20  |
| Johnson Space Center                   | -90  |
| Kennedy Space Center                   | -80  |
| Langley Research Center                | -77  |
| Lewis Research Center                  | -108 |
| Marshall Space Flight Center           | -150 |
| National Space Technology Laboratories | +6   |
| Wallops Flight Center                  | -5   |

The major portion of these adjustments are due to the following considerations:

a. Acceleration of institutional assessment decisions made in 1974 providing that a greater share of project development and research and technology work in selected areas should be performed on prime contract.

b. Consolidation of regional applications work at three Centers including ARC, NSTL, and GSFC.

c. Selective reductions in Civil Service support of space flight programs at JSC, KSC, and MSFC, in areas such as advanced programs and program planning and integration.

d. Consolidation of data management activities at GSFC.

e. Acceleration of the helicopter transfer from LaRC to ARC.

f. Adjustments to the indirect work force.

(Special Announcement from A. M. Lovelace, subject: NASA Civil Service Manpower Adjustments, September 7, 1977.)

September 8: KSC Public Affairs hosted the first NASA Writers Conference Thursday, Friday and Saturday (Sept. 1-3). Eighty writers from across the country

attended the sessions. The purpose of the conference was to acquaint writers with a variety of NASA subjects to write articles about and to direct them to the people and the Center to contact.

A news Center for Voyager 1 was open and manned Saturday, Sunday and Monday (Sept. 3-5) at Frank Wolfe's Beachside Motel to accommodate the press. Representatives who were present included Peter Fairley, Independent Television, London; Jules Bergman, ABC, NY; Craig Couvaut, Aviation Week, Washington, DC; and Jonathan Eberhart, Science News, NY. (Notes-- Hollinshead--9/8/77.)

- o A preliminary Program Requirements Document for the Eastern Test Range radar, telemetry, and communications support by the Ascension Station for Ariane; a French R&D 3-stage launch vehicle, has been received from GSFC and is being prepared for submission to Det. 1, SAMTEC. Support is requested for four launches (from French Guiana) beginning about June 1979. The third stage is an LH<sub>2</sub>/LOX stage. (Notes--Minderman--9/8/77).

September 13: The European Space Agency's Orbital Test Satellite (ESA/OTS) was launched from Complex 17A at the Eastern Test Range (ETR) on a Delta 3914 Launch Vehicle (Mission 134) at 7:21 p.m., EDT, on September 13, 1977. Fifty-four seconds after lift-off, the launch vehicle exploded catastrophically. Prior to the explosion the booster and the five Castor IV strap-on motors ignited on the ground had performed properly. A Delta 134 (OTS) Failure Review Board was established on September 14, chaired by Mr. George Hardy of MSFC, with membership from MSFC, KSC, JSC, LeRC, GSFC (non-Delta) and Headquarters (MQ). The Review Board investigation first determined that the initial failure occurred in the Castor IV strap-on motor in the No. (1) position. This determination was based on careful analysis of flight data, photographic records and substantial vehicle debris salvaged on land and in the ocean near the beach of the ETR Cape Canaveral Air Force Station where the Delta launch complex is located. Investigations to determine the precise failure mode of the No. (1) Castor IV motor are still continuing at this time. ESA has requested that the OTS-Backup mission be launched at the earliest feasible opportunity. The OTS backup has been tentatively scheduled for April 1978, contingent on satisfactory completion of the Review Board investigation and implementation of appropriate corrective actions. (Post Launch, Mission Operations Report, No. M-492-210-77-01 November 9, 1977.)

- o The second free flight mission of the NASA/Rockwell Space Shuttle Orbiter has extended the findings of the initial test flight by demonstrating that the vehicle retains its positive handling characteristics through a wider range of airspeed and aerodynamic loading conditions. Astronauts Joe H. Engle and Richard H. Truly took turns piloting the Enterprise during the the second flight at Dryden last week, before Engle assumed control on final approach and landed the Orbiter on Rogers dry lake Runway 15. Flight time following separation from the Boeing 747 carrier aircraft, at an altitude of 24,000 ft. above this desert test center, was 5 min. 28 sec. to main landing gear touchdown. Runway 17, the primary lake bed landing strip for the Shuttle

approach and landing test program, was used by Astronauts Fred W. Haise, Jr., and C. Gordon Fullerton during the first free flight mission last month. That portion of the lakebed was flooded by unseasonable rains and the runway could not be used for the second mission. (Aviation Week & Space Technology, "Second Flight Confirms Enterprise Data" by Donald C. Fink, September 19, 1977, p.22.)

**September 23:** NASA has selected McDonnell Douglas over Boeing Co. for a \$9 million contract to provide Atlas-Centaur class Spinning Solid Upper Stages (SSUS) which will be used to inject payloads up to 4400 pounds into synchronous transfer orbit from the Space Shuttle orbit. McDonnell is also seeking a contract to build the Delta-class SSUS, which can place up to 2,450 pounds of payload into synchronous transfer orbit, with NASA currently soliciting additional sources. The SSUS-A contract calls for six stages, three of which will be used for Intelsat V flights. The first stage to be built by the company is to be delivered for launch in December 1979, on a demonstration test. The remaining stages will be held in reserve for future missions. To qualify for the SSUS program, contractors must sign an agreement with NASA which specifies a system concept acceptable to NASA; delineates a schedule for development of the system at company expense; and sets forth an agreed-to unit ceiling price and overall ceiling profit that will be observed for the duration of the agreement.

NASA Headquarters, which has entered in an agreement with McDonnell Douglas under which the company will develop a Delta-class Spinning Solid Upper Stage (SSUS-D) for Space Shuttle at its own expense, in lieu of a NASA-funded development, is continuing to solicit additional SSUS-D development sources. The SSUS-D developer(s) will sell the stages directly to users, including NASA and other U.S. Government agencies. To be considered for any Government SSUS-D procurements, potential builders will have to sign an agreement with NASA which: (1) specifies a system concept acceptable to NASA; (2) delineates a schedule for development of the system at company expense; and (3) sets forth an agreed-to unit ceiling price and overall ceiling profit that will be observed for the duration of the agreement. The SSUS-D is a solid propellant, spin-stabilized upper stage to be used as a perigee stage to place payloads up to 2450 pounds into synchronous transfer orbits from the nominal Shuttle orbit of 28.4 degrees inclination and 160 nautical miles altitude. (Defense/Space Business Daily, Vol. 94, No. 13, Friday, September 23, 1977.)

- o The Space Shuttle Orbiter "Enterprise," piloted by astronauts Fred Haise and Gordon Fullerton, made its third successful free flight on September 23 at Edwards Air Force Base, California. Released from its 747 carrier aircraft at an altitude of 23,800 feet, the Enterprise glided to a landing 5 minutes and 34 seconds later. It was the second free flight for Haise and Fullerton, and Haise remarked, "There was a greater degree of pressure on the crew this mission. More so than on the previous flight. This was a time-critical flight and we were so busy we didn't have time to look out the window." The

flight, last of the tail-cone-on series, included a 45 second "hands off" test of the Orbiters "autoland" flight control system and the ground based microwave landing system. The test began at 6500 feet during the Orbiter's straight-on approach to the Mojave desert dry lake bed runway. At 3000 feet Haise "punched out" the autoland system and landed the Enterprise with control stick steering at a speed of 215 mph. The next manned free flight of the Enterprise is scheduled for no earlier than October 18. The flight will be the first with the tail cone off. (Spaceport News, Vol. 16, No. 20, John F. Kennedy Space Center, September 30, 1977.)

**September 26-30:** A celebration of the melding of the talents of people from every racial and cultural background in the aerospace program will be presented the week of September 26th under the sponsorship of the KSC Equal Opportunity Advisory Council. Proclaim Your Heritage Week will combine the objectives of Black History Week, Woman's Week, Hispanic Week and other observances, to channel the efforts of the many people who have worked on these weeks in the past into one program which will be helpful and interesting to every employee. The program will include exhibits, entertainment by choral and dance groups, talks by eminent historians and authorities in the field of human rights, and workshops on career strategies. (Spaceport News, Vol. 16, No. 16, John F. Kennedy Space Center, August 5, 1977.)

**September 29:** A full-scale mockup of a Mercury spacecraft-- with LES, dummy instrument panel, and a suited mannequin--was developed for display in the first Visitor's Center activated for Sunday drive-through tourists in 1964. The exhibit was later mounted on a trailer, displayed at Complex 5/6, moved to the present VIC in 1974, and was frequently made available to various organizations to be towed in parades. Procurement action was recently initiated with a Titusville firm to have the display transferred to a modified, lightweight trailer. While being towed to the work site on September 29, the heat shield fell off on US 1, and the astronaut fell from his seat. A Board of Inquiry has established that dry rot of all the interior wood was the cause of failure and that 500 manhours would be required to effect repair. As a result, the procurement action was cancelled, the spacecraft is being retired, and the astronaut has returned to special quarters to await a new mission. (Notes--Hollinshead--10/6/77.)

- o Final launch preparations for AC-43 were completed without problems and after a trouble-free countdown the vehicle was launched at the opening of the window at 9:03 p.m. EDT on September 29, 1977. The flight was terminated early due to a fire in the Atlas thrust section, beginning at about plus 3 seconds, with the situation degrading until T+36 seconds, when there was positive indication of fire in the area. Vehicle control was lost shortly afterwards leading to an explosion of the Atlas stage at T+54 seconds. The Centaur stage, which had broken free, was destructed by Range Safety at about T+60 seconds. Flight data analysis is in work to determine the cause of the problem. Additionally, an all-out effort is in work to recover as much Atlas

hardware as possible to aid in the failure investigation. The failure investigation is being conducted by the Centaur Project Office while a Headquarters Overview Committee has been formed to assure completeness of the investigation. In support of the investigation, all original documentation has been impounded and, following securing and inspection of Pad A, the pad remains closed awaiting further disposition. (Notes--Kapryan--10/6/77).

- o The experiments on the five Apollo Lunar Surface Experiments Packages (ALSEPs) operating on the Moon will be shut down by NASA Friday (September 30) because the agency does not feel the returns from the \$2 million-a-year operating expenditure justify that funding. The agency also pointed out that at least one of the stations is expected to run out of nuclear power next year. The ALSEPs, built by Bendix Aerospace, were placed on the Moon by Apollo missions 12, 14, 15, 16 and 17, and had a design-life of one to two years. The stations have now been operating for 4 to 7 years. Power is provided by radio-isotope thermoelectric generators built by General Electric. The stations are designed to provide long-term lunar surface geophysical and electrical data, including measurements of: the heat produced by the Moon's interior; the kind and amount of charged particles in the Moon's ion atmosphere; the magnetic environment; and moonquakes and meteoroid impacts. While the experiments will be terminated, the ALSEP transmitters will continue to operate, serving as a reference point in astronomical studies. Total cost of the ALSEP program is estimated at \$200 million. (Defense/Space, Business Daily, Vol. 94, No. 17, Thursday, September 29, 1977.)

**September 30:** John F. Yardley, Associate Administrator for Space Flight, established a review board to investigate the inflight failure of Atlas/Centaur 43, to determine the cause and to recommend required corrective actions. The Board will be chaired by Mr. Milton A. Silveira of JSC. He will be assisted by: Messrs. George T. Sasseen, KSC; Thomas P. Isbell, MSFC; Ed Rothenburg, GSFC; Joseph A. Zremanski, LeRC; and Charles King, NASA Headquarters. The first meeting of the Board was scheduled for Monday, October 3, 1977, at KSC. (TWX to Lewis Research Center, attn: Dr. Lubarsky, Acting Director, from John F. Yardley, Associate Administrator for Space Flight, September 30, 1977.)

## OCTOBER 1977

**October 1:** NASA's John F. Kennedy Space Center will award a \$3,203,666 contract to International Business Machines Corporation for the development of a test system that will check out Space Shuttle cargoes for their compatibility with the Shuttle Orbiter before they are loaded into the Orbiter's payload bay. Called CITE, for Cargo Integration Test Equipment, the system will simulate the Orbiter's electrical and electronic environment. CITE will stimulate the payloads, monitor their responses, and record the data. The payload, not knowing whether it is actually loaded into the Orbiter bay or simply hooked up to the CITE system, will behave the same as it would during actual flight. This capability is needed because of the fast turn-around times planned for Shuttle missions. Being able to have a payload all ready to plug into the Orbiter without extensive testing after it is aboard is necessary to staying on schedule. CITE operations will be conducted in both the Vertical Processing Facility (VPF) and the Operations and Checkout Building (O&C). The first manned orbital flights of the Space Shuttle are scheduled to be launched from here beginning in March, 1979. Because there is no payload on the first Orbital Test Flight, the CITE system will not be operational until the second flight. The cost plus fixed fee contract covers the period between October 1, 1977, and July 1, 1980. (NASA News Release No. KSC 156-77, October 3, 1977.)

**October 3:** The Machinists Union has put Lockheed on notice that the current bargaining agreement will terminate at 12:01 on October 10. The letter cited Lockheed's refusal to negotiate on issues with the implication that strike action will be taken upon expiration. The Air Force will set up Gate 1 for the Reserve Gate should a strike occur in this dispute. (Notes--Lohse--10/5/77.)

- o In another major labor negotiation involving IAM and KSC contractors, the situation looks bleak. Failing to agree on terms of a new contract thus far, the MDAC system wide unit of IAMers voted to authorize strike action if an agreement is not reached prior to expiration of the present contract on October 16. The vote was carried by a 93% margin of those present and voting. Another Gate 2 candidate. (Notes--Lohse--10/5/77)
- o Failing to reach a settlement in renegotiating the system wide bargaining agreement with the company prior to the October 3 expiration of the old contract, the IAM Machinists Union set up picket lines at most Boeing facilities across the nation early in the morning of October 4. Picketing is in progress at Seattle, Wichita, Michoud, Edwards AFB, and at other Boeing locations at this time. (Note--Lohse--10/5/77.)

**October 4:** Members of IAM Lodge 2061 declared strike sanctions against Boeing (Boeing Services International) at approximately 8 pm on October 4. Picket lines were placed at Gate 2 at that time. KSC had previously sent both the company and the union letters advising them that Gate 2 was being set aside as the Reserve Gate in case of strike activity. The Union ignored the procedure and placed pickets at all gates between 6 and 7 a.m. on October 5. After a somewhat hectic day of activity in an all-out effort to confine picketing to Gate 2, KSC was finally successful at about 2 p.m. The Union was reluctant to remove pickets from the neutral gates without positive assurance that Gate 2 control would be rigidly adhered to. This was provided by KSC and BSI's unflinching assurance that such would be the case. Pickets are expected only at Gate 2 from this point forward. Charges of unfair labor practices are being held in abeyance pending compliance with the Gate 2 edict by the IAM. (Notes--Lohse--10/5/77.)

**October 5:** Technical problems encountered during the past year have pushed the estimated R&D cost of the Space Shuttle from four to seven percent (\$210-\$365 million) over the \$5.22 billion (FY '71 dollars) estimate that was given to Congress six years ago. However, NASA has overcome its technical difficulties and still expects to be able to launch the Shuttle on its first flight in March 1979, three months ahead of the official June 1979 launch date. NASA's Associate Administrator for Space Flight, John F. Yardley, said that Shuttle development requirements in FY '77 exceeded the budget estimates by \$123 million, of which \$68 million has been pushed into FY '78, largely through slipping delivery of hardware to Kennedy Space Center by two months. The remainder of the FY '77 cost increase was provided by reprogramming \$30 million from the Apollo-Soyuz Test Project and by using \$25 million of the \$95 million added to the NASA budget under the Economic Stimulus Act. The technical problems on the Shuttle which required additional effort during FY '77 included the main engine turbopump, increased structural and thermal loads from wind tunnel model test data, provision for a backup flight control system, and the Orbiter hydraulic control system and thermal protection system title production. Increased efforts were also required in the manufacturing and assembly of test articles, as well as associated subcontractor work. In addition, higher-than-planned efforts were required for the assembly of the first Orbiter and main propulsion test article, as well as Orbiter subcontractor work, system software, and Solid Rocket Booster subcontractor and tooling activities. The NASA associate administrator said as a result of the FY '77 experience, the approved FY'78 NASA budget for Shuttle development is \$80 million to \$120 million short of what is needed. (Defense/Space Business Daily, Vol. 94, No. 22, Thursday, October 6, 1977.)

**October 6:** NASA's John F. Kennedy Space Center has awarded supplemental contracts totalling \$2,500,345 to Modular Computer Systems, Inc., Ft. Lauderdale, FL, for additional minicomputers and related equipment for further development of the Space Shuttle Launch Processing System (LPS). The awards are fixed price, indefinite quantity contracts. The work will be performed at KSC and at MODCOMP's plant in Ft. Lauderdale. One award, for \$132,269, is

for peripheral devices, including tape units, card readers and line printers, to be used on the minicomputer systems. The second award, for \$2,368,076, is for 16 minicomputers and peripheral system configurations with options for an additional 21. Some of this hardware will also be used for the Cargo Integration Test Equipment Electronic/Electrical Project (CITE), a test system that will check out Space Shuttle payloads before they are loaded into the Shuttle Orbiter payload bay. Including the supplemental awards, total value of the contract is \$10,842,210. The short two-week turnaround time between landing of the Shuttle Orbiter and its subsequent launch requires a speedy method of servicing and refurbishing the Space Shuttle for its next flight. With the LPS, the Space shuttle's main components can be checked out automatically from its arrival at the Spaceport until launch, and then from landing to relaunch. Kennedy Space Center has been designated the prime launch and recovery site for the Space Shuttle. The first manned orbital flights are scheduled to be launched from here in March, 1979. (NASA News Release No. 159-77, October 6, 1977.)

**October 12:** The Space Shuttle Enterprise yesterday completed an apparently flawless powerless approach and landing flight test minus the tailcone over its rocket engines at the Dryden Research Center at Edwards AFB. The Shuttle's 747 carrier aircraft took it to an altitude of 20,536 feet, pausing on the way up to go through a pitchover dress rehearsal, for a two minute 40 second glide to the landing strip. The Space Shuttle dropped swiftly at a 22-degree glide path in the configuration it will have when returning from orbital missions. In the earlier flights an aerodynamic cone was fitted over the rocket engine section to reduce aerodynamic drag and turbulence. The buffeting and vibration of the mated 747 and Space Shuttle during the climb was rated moderate. The Enterprise was commanded by Joe Engle, with Richard Truly serving as pilot. Both astronauts alternated the shuttle's guidance system during the descent at a rate of 7200 fph, reaching speeds of more than 330 mph. The 747 lifted off the Edwards runway at 7:46 a.m. PDT and the Space Shuttle landed at 8:52 a.m. PDT. (Defense/Space Business Daily, Vol. 94, No. 26, Thursday, October 13, 1977.)

**October 20:** NASA Administrator Dr. Robert A. Frosch recently outlined his views about the U.S. space program and NASA's role in connection with the program. The following excerpts summarize what he said. "I have been spending the past couple of months trying to define and redefine, in my terms, and in this Administration's terms, what the role of NASA and the role of space in American life and in human life ought to be. I define a role of being a doing agency and being an agency which is an advocate of space, a finder of things that can usefully be done from space for people. In fact, I think that the single goal over the next few years may be summed up in the word 'usefulness.' We have paid a very high price in money, talent, and manpower to learn how to go into space, how to do things there, and the time is now to continue and to reap benefits that will be useful to everyone. ...The whole point of the game, for the next few years, will be to bring in useful applications based on the technology that we already have, to expand our base



of science, looking outward into the universe, into the environment, between the Sun and the Earth, and back down to Earth, and to beyond these applications and this science. I think that we will have an exciting time with the new technology, and seeing what the new science and the new applications will bring us. I look forward to it..." (Defense/Space Business Daily, Vol. 94, No. 31, Thursday, October 20, 1977.)

**October 22:** Two International Sun-Earth Explorers, ISEE A & B, were successfully launched aboard Delta 135 from Cape Canaveral's Launch Complex 17B. The stacked spacecraft were injected into an orbit having an apogee of 138,120 km and a perigee of 281 km. (The planned orbital parameters called for an apogee of 141,420 km and a perigee of 280 km). Once this orbit was attained the spacecraft were separated by a spring system. ISEE-B was then maneuvered into an orbit with an apogee of 138,317 km and a perigee of 280 km. Eight of the thirteen scientific instruments on ISEE-A were turned on and five of the eight on ISEE-B have been activated. The ISEE Project is an international cooperative project between NASA and the European Space Agency (ESA) which is designed to focus on solar-terrestrial relationships as a joint contribution to the International Magnetospheric Study (IMS), for which the project will provide summary data in a timely manner. The project was formalized by the signing of a Memorandum of Understanding by ESA and NASA in March 1975. The project consists of two missions utilizing three spacecraft with NASA providing the ISEE-A&C and ESA providing the ISEE-B spacecraft. The ISEE-A&B spacecraft will be complemented approximately 9 months later by the launch of ISEE-C into a heliocentric orbit near the Sun-Earth libration point. Individually each spacecraft is capable of contributing to our scientific knowledge. However, the scientific basis and novelty of this mission involves the comparison of simultaneous measurements made by identical instruments on ISEE-A and ISEE-B. Accurate control and knowledge of the separation distance between these two spacecraft will permit a deeper investigation into solar wind and magnetospheric features than has hitherto been possible. Specifically, the ISEE-A/B mission is designed to increase our knowledge of solar-terrestrial relationships by making detailed measurements in the boundary regions which occur as a result of the solar wind impinging on the Earth's magnetic field environment, and to investigate the variations in these boundaries with solar wind fluctuations. (Prelaunch Mission Operations Report, No. S-862-77-01/02, October 11, 1977. Also, Post Launch Mission Operations Report, No. S-862-77-01/02, October 25, 1977.)

**October 25:** NASA's John F. Kennedy Space Center has awarded a contract for \$1,608,750 to the Holloway Corporation, Titusville, FL. The contract, one set aside for small business firms, is for modification of an existing building in the KSC Industrial Area for processing of the parachutes to be used with the Space Shuttle's solid rocket boosters. The solid rockets, along with the Orbiter's main engines, will be ignited at lift-off. The solids will burn for approximately two minutes before being separated from the orbiter at an altitude of 27 miles. The parachutes will cushion the empty solid rocket motor casings' impact in the Atlantic Ocean 185 miles downrange

from the Kennedy Space Center. The solid rocket motor will be retrieved and returned to the Kennedy Space Center for refurbishing. Each casing will be reloaded with propellants and be used for up to 20 missions. Modification work in the parachute facility includes new interior partitions, electrical and plumbing items, construction of new wings and the modification and installation of heating and air conditioning systems. Work under the fixed price contract is to be completed within 300 calendar days. (NASA News Release No. 163-77, October 26, 1977.)

**October 26:** Control difficulties encountered with the Space Shuttle Orbiter Enterprise, which bounced twice and rolled sharply during its first operational-type landing on the main concrete runway at Edwards AFB, have forced Shuttle program officials to consider flying a repeat of what was supposed to have been the last free flight mission. The problems occurred during the final approach and touchdown portions of the 1-min. 59-sec. free flight after the Enterprise came out of the pre-landing flare at 290 keas. (knots equivalent airspeed) instead of the planned 280 keas. In an attempt to slow the final descent from an altitude of 2,000 ft., the crew dropped the Orbiter's landing gear at 290 keas, 40 keas. above the planned deployment speed. But the vehicle continued to accelerate and was 20 keas. fast over the runway threshold. Orbiter commander Fred W. Haise, Jr., then activated the split rudder speed brake system and pitched the vehicle forward to force it onto the runway close to the targeted touchdown point. The left wing dropped sharply just prior to touchdown, but Haise rolled the Orbiter's wings level just before the main gear units hit. Instead of staying on the ground, the Enterprise bounced about 20 ft. into the air and rolled sharply to the left and right as Haise struggled to keep it aligned with the runway. Haise said following the flight that he was not certain whether the roll excursions were caused by the flight control system or pilot-induced oscillations. Orbiter copilot C. Gordon Fullerton told him to relax his grip on the stick during the first long bounce, and the roll oscillations damped out fairly quickly, Haise said. The wings were level when the Enterprise touched down the second time, but the Orbiter bounced off the hard surface runway again before touching down the final time. The landing rollout was relatively uneventful, and moderate to hard braking brought the Orbiter to a stop near the 12,000 ft. mark on the 15,000-ft long runway. (Aviation Week & Space Technology "Orbiter Experiences Control Problems, by Donald E. Fink, October 31, 1977, p.16.)

- o NASA's John F. Kennedy Space Center has awarded a \$105,844 contract to Fluid Scientific, Inc., Orlando, FL, for five hydraulic hose sets and various mating disconnects. The hose sets will be used to connect and carry hydraulic fluid from the ground support equipment fluid distribution system to the Space Shuttle Orbiter and two Solid Rocket Boosters (SRB) while the Shuttle is on the launch pad or under checkout in the Vehicle Assembly Building or Orbiter Processing Facility. The Shuttle Orbiter has one system to supply electrical power and another system to supply hydraulic power. Hydraulic power is derived from three independent hydraulic pumps, each driven by its own hydrazine-fueled auxiliary power unit and cooled by its own water boiler. The three independent hydraulic fluid systems provide power to operate various Orbiter systems including the elevons, rudder/speed brakes, body flap,

main engine gimbal and control systems, landing gear, brakes, and steering. The SRB uses hydraulics for thrust vector control of the motor nozzle. The contract, made to a small business firm, requires the hardware to be delivered on or before March 1, 1978. Kennedy Space Center has been designated the prime launch and recovery site for the reusable Space Shuttle, scheduled for its first manned orbital flight in the spring of 1979. (NASA News Release No. 184-77, November 17, 1977.)

**October 28:** NASA has awarded a \$16 million letter contract to McDonnell Douglas Astronautics for four Delta launch vehicles, the last to be delivered in November 1979. This is NASA's final buy on the Delta vehicle as it shifts to the Space Shuttle. It said earlier that its last buy could consist of four or five vehicles. Three of the new Deltas will be the 3900 series, which can employ nine Castor IV strap-on solid motors; the fourth is of the 2900 series, which employs the smaller Castor II solid strap-ons. (Defense/Space Business Daily, Vol. 94, No. 36, Friday, October 28, 1977.)

- o NASA said Friday that it plans to go ahead with the plan to boost the orbiting Skylab space station to a higher orbit to prevent it from breaking up and falling in pieces into the atmosphere, to make it available for possible future astronaut visits. The Skylab reboost mission is scheduled for the fifth Orbital Flight test of the Space Shuttle in February 1980, employing a remotely controlled propulsion system that would dock with the Skylab and propel it into higher orbit. It has been estimated that the 85-ton Skylab, launched into space on May 17, 1973, would decay in 1981. It is in an orbit of about 200 miles. The last manned visit to the station ended in February 1974. (Defense/Space Business Daily, Vol. 95, No. 1, November 1, 1977.)
- o NASA, after the Space Shuttle Orbiter bounced three times on landing in its last scheduled free flight last week, said it was considering an additional test in mid-November. It has decided that the extra test is not needed. Still on the schedule for the Orbiter is at least two more piggy-back flights on its 747 carrier aircraft, to test the long-range capability of the two vehicles. The Orbiter is to begin vibration tests at Marshall Space Flight Center in March. (Defense/Space Business Daily, Vol. 95, No. 1, November 1, 1977.)

**OCTOBER:** A calm water maneuvering test of the Space Shuttle prototype Solid Rocket Booster Dewatering set--or nozzle plug--staged last week at the Navy's Trident Basin in Port Canaveral, proved about 80 percent successful, said Test Manager Bob Everette. Basically, the nozzle plug is a long cylindrical metal cork. Operated remotely, through an umbilical cord from on-board a ship, the plug fits snugly into the tail section of the solid booster casing and pumps the water out using compressed air, thereby enabling it to rotate to a horizontal position for easy towing back to the Spaceport for refurbishment and eventual reuse. Everette said some minor modifications will be made

to the plug in preparation for the full ocean tests which will take place near Port Everglades during the week of December 5. For the first time, a test fixture, which simulates exactly the rear portion of the SRB, will be used to test the plug under actual recovery conditions. Participating in the calm water tests were personnel from KSC, the Naval Ocean Systems Center that built the prototype plug, and United States Booster, Inc., support contractor for the tests. (Spaceport News, Vol. 16, No. 22, John F. Kennedy Space Center, NASA, October 28, 1977.)

OCTOBER: During FY 77, the KSC Procurement Office received and processed 22,828 procurement requests, resulting in 23,747 procurement actions with a total dollar value of \$237,276,735. KSC met and exceeded its FY'77 goals pertaining to small and minority businesses. The following is a resume:

|                           | <u>FY 77 Goals</u> | <u>FY 77 Actuals</u> |
|---------------------------|--------------------|----------------------|
| Small Business Percentage | 9%                 | 18.41%               |
| Small Business Dollars    | \$21,100,000       | \$39,600,000         |
| Minority 8 (a) Dollars    | \$ 2,750,000       | \$ 2,850,000         |

Also, the FY'77 percentage of set-asides for small business almost doubled that of the previous year, showing an increase from 3.5 percent to 6.8 percent. (Notes--Lohse--10/27/77)

NOVEMBER 1977

**November 1:** NASA's John F. Kennedy Space Center has awarded a contract for \$5,745,000 to the Frank Briscoe Company, Inc., East Orange, New Jersey. The fixed price contract is for modifications to Launch Complex 39's Vehicle Assembly Building, to prepare it for use in the Space Shuttle program. The Briscoe contract includes the reconfiguration of work platforms in High Bay 1 to accommodate the mating and checkout of Space Shuttle flight components, installation of External Tank checkout cells in High Bay 2, modification of Low Bay cells for storage of the Space Shuttle Main Engine, upgrading of the fire protection system and life safety features, and other modifications. Work under the contract is to be completed in approximately 10 months. (NASA News Release No. 167-77, November 2, 1977.)

**November 4:** NASA's John F. Kennedy Space Center has awarded a \$157,200 contract to Morton Company, Hayward, CA, for the construction of two crew hatch access vehicles which will allow the Orbiter crew to exit the Orbiter cabin in a weather-protected environment. Similar to standard passenger access ramps used at many major airports, the crew hatch access vehicles will employ telescopic stairs mounted atop a truck. Because of the delicate instruments housed in the Orbiter cabin, a special weather-tight room will be built at the top of the stairs. This will keep moisture out of the cabin and allow the astronauts to enter and exit the Orbiter while being protected from bad weather. The fixed price contract, one made to a small business firm, is to be completed by March 1, 1978. (NASA News Release No. 166-77, November 4, 1977.)

- o NASA's John F. Kennedy Space Center has awarded a fixed price contract for \$789,907 to the Mayfair Construction Company, Chicago, for construction of a utilities control system for the Launch Complex 39 area. The work includes modifying sensors and controls, or providing new ones, for the Launch Control Center, Vehicle Assembly Building, VAB annex and outlying areas of the Spaceport's launch area. Many of the historic Launch Complex 39 facilities, built for Apollo journeys to the Moon, are being reshaped for their new roles in the Space Shuttle era. Work under the contract is to be completed by July, 1978. (NASA News, Release No. 166-77, November 4, 1977).

**November 8:** A NASA reorganization will become effective November 8, 1977. The new organization is designed to achieve the following major objectives:

1. To simplify the Headquarters organization structure and reduce the number of people in the Headquarters.

2. To reduce the number of staff offices reporting to the Administrator.
3. To establish an integrated interface to agencies and institutions and to the general public through an Office of External Relations.
4. To provide a direct line management relationship between the Administrator and the Headquarters program Offices.
5. To establish a direct reporting relationship between the Center Directors and the Administrator.
6. To establish a position of Chief Scientist to promote across-the-board agency cognizance over scientific affairs and interaction with the scientific community.

The reorganization will result in a reduction of 33 people from the Headquarters current staff of 1558. (NASA Special Announcement by Robert A. Frosch, Administrator, Subject: NASA Reorganization, October 25, 1977.)

November 10-17: Machinists voted last last night by a two to one margin to reject the last offer made by TWAS in the VIC dispute. The rejection raises the spectre of a strike at midnight on Thursday, November 17. Union Representatives indicate an all-out effort will be made before the deadline to resolve outstanding issues. The primary issue seems to be the Union demand for an insurance package for part-time employees identical to the one provided for full-time people.

No progress is noted in the local BSI/IAM situation. No meetings have been held over the past several days--mainly because the IAM players are in Seattle participating in the National negotiations. Violence is becoming more frequent on the picket lines. Several cars have been splashed with an acid substance, causing severe damage to the finish. Another attack on a Leonard brothers truck occurred Monday when a side window was knocked out as the rig passed pickets on State Road 3. The Brevard County Sheriff's Office has called us and requested that we attempt to get pickets to cool it on the lines. Mr. Gooch, AP-LRS, has registered strong protests with IAM about the unruly conduct of the picketers. On November 10, the NLRB advised the IAM that picketing at Gates 3 and 4 in the current dispute with BSI was in violation of the National Labor Relations Act. The Union was requested to comply with the Board Order and remove the pickets. This was done at 4 p.m. the same day. (Refusal to comply would have resulted in the Board petitioning the Orlando Federal Court for injunctive action in enforcing their decision.) (Notes--Lohse--November 17, 1977).

**November 21:** Nearly 200 KSC, Air Force, Navy, and contractor employees, plus three private citizens, were honored Tuesday at the KSC Annual Awards Ceremony. NASA Deputy Administrator Alan M. Lovelace shared the podium with Center Director Lee R. Scherer and Deputy Director Gerald Griffin in presenting the awards. One of the highlights of the ceremony was the presentation of the first annual "Director's Award." Selected personally by the director on the basis of contributions to the Center, the honoree receives a \$2,500 cash award. Thomas Walton of Shuttle Engineering was this year's award winner. Annie Joe Hester, Chief, Pay and Travel Section, Accounting Branch, was honored as Woman of the year. The EO Award of the Year was bestowed on William S. Simmons, Chief, Staffing and Personnel Services Branch.

**November 22:** The European Space Agency's Meteorological Satellite (Meteosat) was launched into a synchronous transfer orbit from Launch Complex 17B of the Eastern Test Range at 8:35 p.m., EST, on November 22, 1977, by a Delta 2914, Vehicle Mission Number 136. Performance of the Delta launch vehicle was nominal and placed the spacecraft and its apogee boost motor (ABM) into the desired transfer orbit. The orbital elements achieved were an apogee of 37,001 km and a perigee of 147 km, as compared with an expected apogee and perigee of 37,191 km and 185 km respectively. The satellite performed satisfactorily during the transfer orbit, and the ABM was fired successfully at 1:19 p.m., EST, on November 23, 1977. The satellite is being maneuvered over the South Atlantic to a position on the Greenwich Meridian (zero degrees longitude) above the equator. At this time, all subsystem functional checks are complete and satellite status is satisfactory. The satellite is designed to conduct meteorological experiments to investigate thermal characteristics and cloud imagery from geostationary orbit as part of the Global Atmospheric Research Program (GARP). (Prelaunch Mission Operation Report, No. M-492-102-77-01, November 16, 1977. Also, Post Launch Mission Operation Report, No. M-492-102-77-01, February 28, 1978.)

**November 29:** Sen. William Proxmire (D-Wis.) says his HUD-Independent Agencies Appropriations Subcommittee, responsible for funding NASA programs, will hold a hearing on December 1 to "look at a Space Shuttle overrun of \$100 million and related Shuttle problems, including scheduling delays and a possible failure to meet performance goals." Proxmire said that NASA "for the first time has admitted" there will be an overrun of between four percent and seven percent in the cost of the Space Shuttle. Even more disturbing, he said, are indications that there may be significant delays in implementing the Shuttle system and performance degradations that could impair or destroy "the Shuttle's cost advantages" over conventional launch vehicles. "NASA has informed me that it plans to reprogram \$100 million from Shuttle production into design, development, test and evaluation (DDT&E) to maintain the Shuttle development schedule on an efficient and timely basis." Proxmire said his December 1 hearing will allow Congress to explore areas such as: "Are Shuttle weight margins unrealistically low, and will we ultimately face reduced payload capability?" "Can we expect reusability goals for such Shuttle components as the main engine and thermal tiles to be achieved, and if NASA

fails to achieve these goals, how much will user charges increase?" "Is the 160 hour turnaround time projected for the Shuttle by NASA in jeopardy?" "Is the safety of the space transportation system being compromised in an attempt to save money by cutting corners?" "By reprogramming production funds into design, development, test and evaluation and thus delaying production schedules will NASA be increasing total production costs?" (Defense/Space Business Daily, Vol. 95, No. 19, Tuesday, November 29, 1977.)



DECEMBER 1977

**December 1:** NASA officials told Congress yesterday that a \$100 million overrun in the cost of development of the Space Shuttle and a resultant six months delay in the delivery of the last three Shuttle Orbiters will not affect the first manned orbital flight of the spacecraft in 1979. NASA Administrator Robert A. Frosch; John F. Yardley, NASA Associate Administrator for Space Transportation Systems; and William E. Lilly, NASA comptroller, defended what amounts to a 5-7 percent cost growth and six months delay out of seven years in the Space Shuttle program, in a special hearing by Sen. William Proxmire's (D-Wis.) HUD-Independent Agencies Appropriations Subcommittee. Frosch pointed out that this is "not the most severe" instance of cost overrun or delay. "It is not an extreme problem," he emphasized. The NASA officials also stressed that the agency's reprogramming of funds within the approved budget in order to cover the added costs is an action that does not require congressional action or approval, but rather is a shifting of funds within a line item.

Frosch explained that during FY 1977, NASA encountered problems in the \$1.288 billion budget plan for the Space Shuttle, resulting in increased funding requirements. The increase, he said, was due to technical problems requiring redesign and additional test efforts. These technical problems included the engine turbopump and the Orbiter hydraulic system. New requirements included the addition of a backup flight control system and updated structural and thermal load increase resulting from new wind tunnel tests. There was also an increase in the requirements of the Orbiter thermal protection system. In hardware fabrication, more manpower was required for the assembly of Orbiter 101, the main propulsion system, Orbiter subcontractor components and tooling efforts. The NASA Administrator told the hearing that part of the additional costs was offset by the reprogramming of \$30 million and the addition of \$25 million from the Economic Stimulus Appropriation Act of FY 1977. A planned outlay of \$68 million was deferred to FY 1978. NASA decided to accomplish the work deferred from FY '77, in FY '78, while implementing additional changes to the system, Frosch said. Adjustments were made to reduce FY '78 requirements, including the reduction of Approach and Landing Tests (ALT) as a result of the success of the early flights--engine turbo pump tests were transferred from Rockwell's Rocketdyne Division component test facility at Santa Susana to the full engine test facility at the National Space Technology Laboratory; and the first flight hardware to the Kennedy Space Center was delayed by two months. Frosch said the first launch date was held by compressing the Shuttle checkout and assembly time at the Kennedy Space Center. (Defense/Space Business Daily, Vol. 95, No. 22, Friday, December 2, 1977.)

**December 2:** At the presentation December 2 of the Lightning Program proposed for KSC in 1978, the Center Director authorized a recertification of KSC's invitation to the Scientific Community to continue their Thunderstorm

Research International Program studies at KSC in the summer of 1978. The invitation was extended at a special session of the American Geophysical Union Meeting in San Francisco on December 5 and was accepted. This will be the last year that KSC will host these studies; after 1978 the program will move to study the thunderstorms at other locations, where storms differ in nature from those at KSC. The 1979 program will be conducted at Siorro, New Mexico, at the Langmuir Laboratories. (Notes--Clark--12/15/77.)

**December 5-9:** The first open sea development tests of Space Shuttle retrieval equipment staged from the Port Everglades went well. The tests, which ran from December 5-16, tested the operation of parachute retrieval equipment and procedures for the use of the nozzle plug. The tests were hindered both weeks by strong winds and choppy seas ranging from three to six feet. However, most objectives were achieved. Huge waves created many variables vital to the tests. The aft section of the 158-foot offshore support vessel used in the tests was often under a foot of water. The first group of tests concerned parachute recovery. Two support vessels will be used for the retrieval of the six main parachutes and two drogue chutes. Each vessel will be responsible for recovering three main chutes and a frustum-drogue chute combination. The parachutes are reeled up on large spools, covered by a protective tarpaulin and returned to the parachute refurbishment facility at KSC, where they will be washed, dried, folded and repacked. The second series of tests verified the nozzle plug's ability to perform in open waters. The nozzle plug will swim out from the ship to a vertically floating solid booster casing, dive to the bottom of the casing, secure itself in the rear portion and pump out the water-filled cavity. This will cause the booster to rotate to a horizontal position so it can be towed back to the Spaceport for refurbishment and eventual reuse. AN SRB test fixture was used for testing the plug's docking capabilities. In addition, the tests helped determine the final deck layout of support vessels to be used, and how well the ship can maintain its position while the plug is docking with the solid booster. Taking part in the tests were personnel from KSC and NASA's Marshall Space Flight Center, several contractors and other agencies including: Tracor Marine, which maintains the support vessel "G. W. Pierce" used in the tests; Everglades Towing Company, which supplied tugs, work boats and manned the Landing Craft Utility (LCU) boat; the Naval Ocean Systems Center, builders of the prototype nozzle plug; United Space Booster, Inc., support contractor for the tests; and Battelle Memorial Institute, who designed and fabricated the parachute retrieval equipment. Pioneer Parachute Co., which built the parachutes, U. S. Naval Supervisor of Salvage, and Martin Marietta also took part in the test. Bob Everette was the test manager. (Spaceport News, Vol. 16, No. 26., John F. Kennedy Space Center, NASA, December 23, 1977.)

**December 14:** The Japanese Communications Satellite (Japan/CS) was launched into a synchronous transfer orbit from Launch Complex 17B of the Eastern Test Range at 7:47 p.m. EST, on December 14, 1977, by a Delta 2914, Vehicle Mission Number 137. Performance of the Delta launch vehicle was nominal and

placed the spacecraft and its apogee boost motor (ABM) into the desired transfer orbit. The orbital elements achieved, compared with the nominal expected, are as follows: Apogee, 35,953 km, perigee, 166.0 km; and apogee, 36,103 km, and perigee of 166.0 km respectively. The satellite performed satisfactorily during the transfer orbit, and the ABM was fired successfully at 10:27 p.m. EST, on December 15, 1977. The satellite is being maneuvered over the South Pacific to a position approximately 135 degrees East longitude above the equator and south of Japan. At this time, all subsystem functional checks are complete and satellite status is satisfactory. The CS satellite is designed to conduct communication technology experiments of telephone and television signals between fixed and mobile stations and establish operational technology systems. The spacecraft prime contractor is Ford Aerospace & Communications Corp. (FACE), Palo Alto, California, under contract from Mitsubishi Electric Co., Nagoya, which has prime contract responsibility from NASDA. After T+5 days prime tracking and control responsibility will be transferred to the Japan Tracking & Control Center (TACC) at Tsukuba Space Center in Tokyo. (Prelaunch Mission Operations Summary, Report No. M-492-211-77-01, December 14, 1977. Also, Post Launch Mission Operations Report, No. M-492-211-77-01, February 28, 1978.)

**December 21:** Savings of more than 1.6 million kilowatt hours of electricity and 13,000 gallons of fuel oil will be achieved by the Kennedy Space Center during the holiday period as most government and contractor employees take annual leave between December 23 and January 3.

"By closing some buildings and turning off electricity in most areas the Center will not only conserve the electricity and fuel oil, but should save some \$53,000 in actual expenditures," said Charles A. Adams, KSC's chief of utilities engineering and operations.

Limited curtailment of Spaceport operations during the 1976 Christmas holiday period resulted in savings of 80,000 kilowatt hours per day.

With all but a limited number of essential employees on annual leave and most electrical and heating/air conditioning systems turned off during the four-day Thanksgiving weekend, the Center saved 765,000 kilowatt hours of electricity and 6,500 gallons of fuel oil. Dollar savings totaled about \$25,000.

An emergency crew at the KSC dispensary and required security and fire protection personnel will be on duty during the holiday period, and some construction contractor personnel will be at work during the December 27-30 period. (NASA News Release No. 216-77, December 21, 1977.)

**December 31:** At the close of 1977, the total value of KSC's real property and equipment was placed at \$1,199,422,758. Of this amount the value placed on NASA's Cape Canaveral Air Force Station facilities was placed at \$60,774,343. KSC facilities are valued at \$615,779,354. This marks a \$9,544,946 loss, primarily in the value of KSC facilities, since December 1976. Capital equipment and special test equipment held by the government and government contractors totalled over 522 million dollars. (KSC Real Property Inventory Report as of December 31, 1977. Also Addendum 1, January 6, 1978.)

**December:** As of December 1977, plans to renew manned space flight are well underway. They are scheduled to begin next October when Orbiter 102 will be brought to KSC atop its 747 carrier aircraft. In November and December, the remainder of the Space Shuttle flight kit--Orbiter main engines, External Tank and Solid Rocket Booster motors (SRBs)--will arrive at KSC. Along with the Orbiter, they will enter the test, assembly and checkout pipeline which will culminate in a scheduled launch from Complex 39's Pad A in March of the following year. After completion of six development flights, including four landings at Edwards AFB, California, the Space Shuttle will commence operational missions from the Kennedy Space Center in May 1980.

Construction of new facilities and modifications to existing ones are proceeding on schedule at KSC to support the Shuttle's debut.

The Orbiter Landing Facility, where the Shuttle Orbiter will land on its return to Earth, was completed last August. Supporting facilities such as the Mate-Demate Device, to offload the Orbiter from its 747 carrier aircraft, and the Microwave Landing System, to guide the Orbiter to an automatic landing, will be completed in April 1978. Meteorological sites to support landing operations were completed in November of this year.

The Orbiter Processing Facility, located adjacent to the VAB and connected to the landing facility by a 3.2-kilometer (2-mile) towway, is essentially completed except for the installation of some remaining stands and systems expected to be in place by April. The two-bay structure will serve as an aircraft "hangar". It is here, in a "clean room" environment, that ordnance and residual fuels will be rendered safe, flight and landing systems will be refurbished, and payloads will be removed and installed.

The Orbiter Landing Facility and the Orbiter Processing Facility are the only new facilities required to support Shuttle operations at KSC. The remaining Shuttle preparations consist of modifications to existing facilities originally designed and built to support the Apollo lunar landing missions.

Saturn Mobile Launcher 1, stripped of its umbilical tower and sporting three openings to permit exhaust gases from the Orbiter's main engines and solid rockets to escape during liftoff, is now being equipped with piping and

cabling systems. It will be moved into High Bay 3 of the VAB in January where it will undergo further activation.

Modifications are currently underway on Mobile Launcher 2. Basic reconfiguration work will be finished in the last quarter of 1978. Installation of internal systems will continue into 1979.

The VAB, which once housed Apollo-Saturn V moon rockets, also is getting a facelift. High Bays 1 and 3 will be used to stack and integrate the Shuttle's flight components.

Modifications, consisting primarily of piping, cabling, work platforms and various electrical and pneumatic systems, are essentially completed in High Bay 3. Modifications to High Bay 1 will be finished in the third quarter of 1978.

The External Tank, which will carry the fuel to power the Orbiter's main engines, and the SRBs, which will give the Orbiter the added kick to get into space, will be stored in High Bays 2 and 4. Modifications there, to be completed in the first quarter of 1978, include the addition of heavy cranes and railroad spurs to haul in the SRBs.

The VAB's low bay is being reconfigured to serve as a refurbishment site for portions of the SRBs. Modifications, which include the installation of small cranes, will be completed in January.

Firing Rooms 1 and 2 of the Launch Control Center, "brain" of the complex, are being outfitted with the highly automated Launch Processing System (LPS) developed for Shuttle checkout and launch.

Basic modifications to both firing rooms have been completed, with the exception of the Uninterrupted Power System which will be ready in the first quarter of 1978.

The LPS consoles and associated equipment are in place in Firing Room 2, software integration is completed and the entire system has been turned over to the user for refinement. Firing Room 1 software integration is currently in process with a targeted completion date of February 15.

The Shuttle LPS system will require only about one-tenth of the manpower needed for Apollo--45 as compared to 450. Final countdown for a Shuttle launch will require only about two and one-half hours instead of the 28 hours needed for the final countdown of an Apollo-Saturn V vehicle.

Basic modifications to Pad A of Launch Complex 39, site of Shuttle launches, will be completed by the second quarter of 1978. Major changes include a fixed Shuttle Service Access Tower, a water sound suppression system to protect Shuttle crews and payloads from accoustical damage during liftoff, and a Payload Changeout Room (PCR) which provides the capability of loading and unloading payloads at the launch pad.

The PCR is a "white room" structure mounted on a semicircular track extending from the Shuttle Service and Access Tower. It is retracted along its track to its park site prior to launch.

Modifications to transform Pad B from Saturn to Shuttle operations are expected to begin in the second quarter of 1978.

The ponderous Crawler-Transporters (CTs), the huge tracked vehicles previously used to cart Apollo-Saturn V flight hardware around the complex, will be refurbished and readied to carry the assembled Space Shuttle and its Mobile Launch Platform between the VAB and Complex 39's two launch pads.

Modifications consist mainly of replacing outdated electrical items and upgrading reliability to meet today's state-of-the-art. Work on CT-1 will be completed by December 1978, on CT-2 by the end of 1979.

In addition to the Shuttle preparations underway at Launch Complex 39, modifications are proceeding, or scheduled, on facilities in the KSC Industrial Area. They are:

- \* Hypergol Maintenance Facility--to be used for offline refurbishment, retest and checkout of the Orbiter's aft propulsion system and forward reaction control system after each mission. These systems use highly toxic hypergolic propellants which ignite on contact with each other.

Structural changes to the facility were completed in mid-1977. Site activation work currently is in progress.

- \* Operations and Checkout Building--the high bay and checkout areas, which once accommodated Apollo spacecraft before they were mated to the launch vehicle, are being reshaped to handle the European Space Agency's scientific workshop, Spacelab, expected to be a frequent "passenger" aboard the Shuttle Orbiter. Work in these areas will be completed in the third quarter of 1978.

- \* Parachute Facility--being modified to handle the large parachutes that will lower the Shuttle's spent solid rocket motors to a safe landing in the Atlantic minutes after liftoff.

Each of the Shuttle's two solid rocket motors is equipped with a pilot chute, a drogue chute and three main chutes. the mains are each 35 meters (115 feet) in diameter and weigh 680 kilograms (1,500 pounds).

The facility will be equipped to wash, dry, store and package the parachutes for reuse. Work here is scheduled for completion in the third quarter of 1978.

\* Spacecraft Assembly and Encapsulation Facility (SAEF-1)--to be modified and redesignated as the Vertical Processing Facility (VPF) which will permit the checkout, processing and integration of Shuttle vertical payloads and cargoes prior to installation in the Shuttle Orbiter at the launch pad.

Vertical payloads include, but are not limited to, the Interim Upper Stage (IUS), Spinning Solid Upper Stages (SSUS) and the Teleoperator Vehicles. These flight elements, to be carried aloft by the Shuttle Orbiter, will be utilized to place payloads into high-Earth orbits and planetary trajectories which cannot be accomplished by the Shuttle vehicle.

Transformation of SAEF-1 into the VPF will begin approximately the second quarter of 1978, with an operational readiness date of July 1, 1979.

Only one structure on Cape Canaveral Air Force Station will be modified to support Shuttle operations. Hangar AF will be transformed into a Solid Rocket Booster Recovery and Disassembly Facility. It will serve as a receiving and disassembly site for the reusable SRBs after their retrieval from the ocean following Shuttle launches. Modifications, which will begin in January and be completed in the last quarter of next year, will include a barge slip at the rear of the building.

The eventual cost of construction, modification work and ground support equipment to support Space Shuttle operations at the Kennedy Space Center will be approximately \$700-800 million. (NASA News Release No. 210-77, December 19, 1977.)

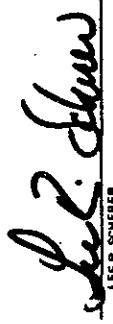
APPENDIX A

KSC ORGANIZATION CHARTS

|               |       |     |
|---------------|-------|-----|
| 19 APRIL 1977 | ..... | A-1 |
| 14 JULY 1977  | ..... | A-2 |



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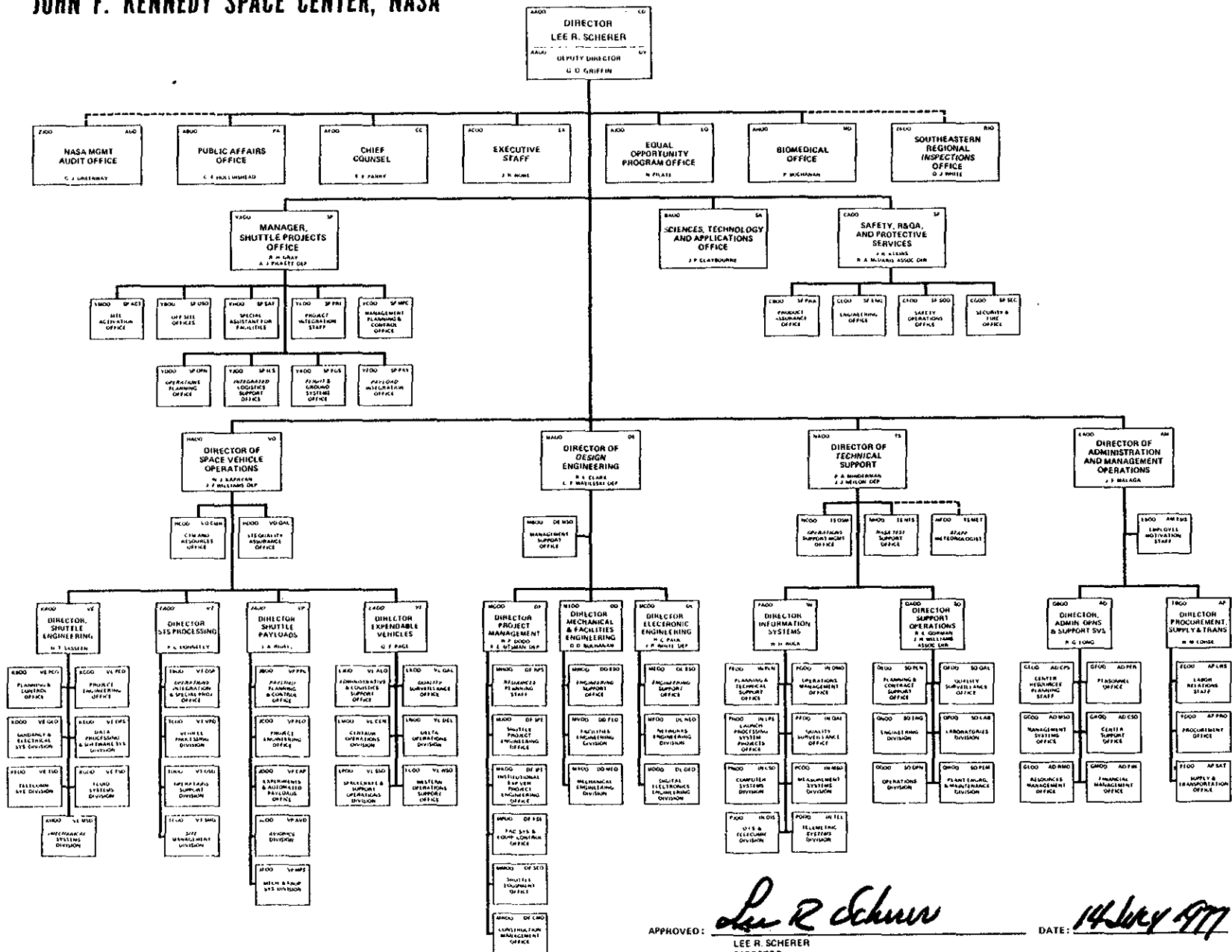
DATE:

19 Aug 1977

APPROVED: Lee R. Scheren  
LEE R. SCHEREN  
DIRECTOR

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**JOHN F. KENNEDY SPACE CENTER, NASA**



APPROVED:

LEE R. SCHERER  
DIRECTOR

**DATE:**

14 July 1977

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APPENDIX B

MAJOR NASA LAUNCHES  
JANUARY THROUGH DECEMBER  
1977

# APPENDIX B

## MAJOR NASA LAUNCHES - JANUARY - DECEMBER 31, 1977

| <u>DESIGNATION</u> | <u>DATE</u> | <u>LAUNCH VEHICLE</u> | <u>SPACECRAFT</u> | <u>LAUNCH PAD</u> | <u>TEST NO.</u> | <u>RESULTS</u> |
|--------------------|-------------|-----------------------|-------------------|-------------------|-----------------|----------------|
| NATO 111 B         | 1-27-77     | Delta 128             | NATO 111 B        | 17A               | 4499            | S              |
| Palapa 2           | 3-10-77     | Delta 129             | Palapa B          | 17A               | 1500            | S              |
| GEOS (ESA)         | 4-20-77     | Delta 130             | GEOS              | 17B               | 0747            | P              |
| Intelsat IV-A      | 5-26-77     | Atlas-Centaur 39      | F-4               | 36                | 1666            | S              |
| GOES 2             | 6-16-77     | Delta 131             | GOES B            | 17B               | 1967            | S              |
| GMS (Japan)        | 7-14-77     | Delta 132             | GMS               | 17B               | 6245            | S              |
| HEAO 1             | 8-12-77     | Atlas-Centaur 45      | HEAO-A            | 36B               | 3133            | S              |
| Voyager 2          | 8-20-77     | Titan-Centaur 7       | Voyager 2         | 41                | 0808            | S              |
| Voyager 1          | 9-5-77      | Titan-Centaur 6       | Voyager 1         | 41                | 0777            | S              |
| SIR10              | 8-25-77     | Delta 135             | SIR10             | 17B               | 5999            | S              |
| OTS                | 9-13-77     | Delta 134             | OTS               | 17A               | 4010            | U              |
| Intelsat IV-A      | 9-29-77     | Atlas-Centaur 43      | F-5               | 36A               | 2050            | U              |
| ISEE               | 10-22-77    | Delta 135             | ISEE A&B          | 17B               | 1133            | S              |
| METEOSAT (ESA)     | 11-22-77    | Delta 136             | METEOSAT          | 17B               | 0450            | S              |
| CS (Japan)         | 12-14-77    | Delta 137             | CS                | 17B               | 1555            | S              |

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